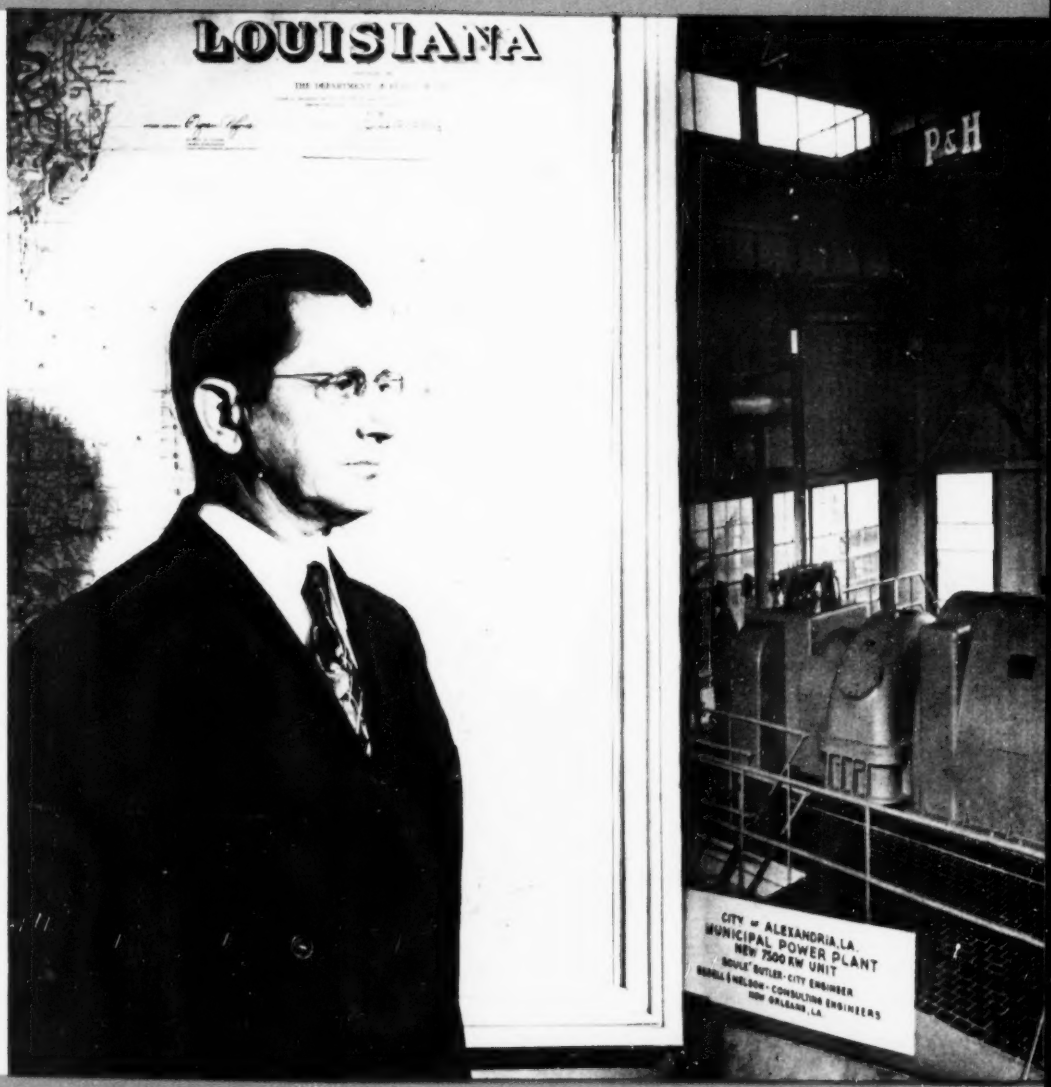
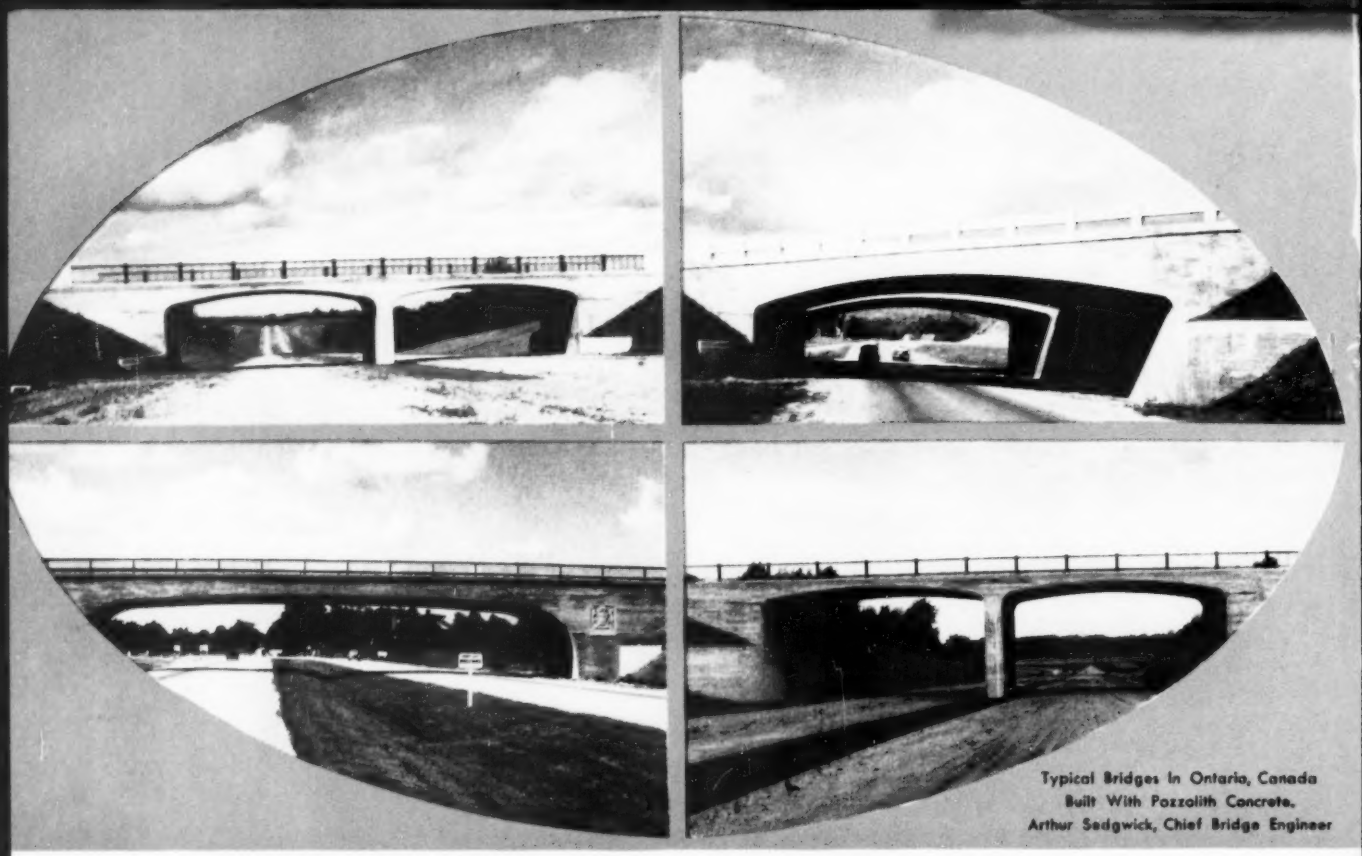
PUBLIC WORKS

Oct. 1953

CITY, COUNTY AND STATE



Soulé Butler, City Engineer of Alexandria, Louisiana, shown as he inspects the Alexandria Municipal Power Plant. **More on page 20.**



Typical Bridges In Ontario, Canada
Built With Pozzolith Concrete.
Arthur Sedgwick, Chief Bridge Engineer

90 Bridges In Ontario Are POZZOLITH CONCRETE

BACK in 1938 the Ontario Highways Department built two bridges of identical design — one with Pozzolith Concrete, the other with plain concrete. Their reason for employing Pozzolith was to increase workability, making practical the use of a low water-cement ratio concrete in a thin, heavily reinforced section.

Such marked improvements were obtained in the concrete produced with Pozzolith that since that time, with the exception of an interval during the war years, all highway department bridges in Ontario have been Pozzolith Concrete.

In other provinces and in many states, Pozzolith Concrete has similar acceptance for use in highway bridges.

Among the improved qualities obtained with Pozzolith Concrete are the following:

- GREATER DURABILITY — for longer life concrete
- REDUCED SHRINKAGE — for less cracking
- LOWER PERMEABILITY — for less "waterproofing" expense
- MINIMIZED SEGREGATION — for better appearance
- INCREASED BOND-TO-STEEL — for better construction
- EASIER PLACEABILITY — for lower placing costs

Full information on Pozzolith and "See-for-yourself" demonstration kit supplied on request . . . without cost or obligation.

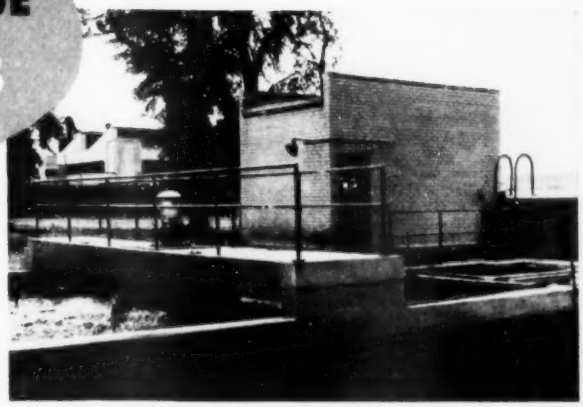
the MASTER BUILDERS Co.

CLEVELAND 3, OHIO — Subsidiary of American-Marietta Company — TORONTO, ONTARIO

CHICAGO SEWAGE EQUIPMENT

ACTIVATED SLUDGE 'PAKAGE' PLANTS

OVER 230 IN OPERATION



Activated Sludge 'Pakage' Plant installed for the Goodyear Tire & Rubber Company Plant, Topeka, Kansas. This 18' unit is designed to treat 125,000 gallons per day. J. G. Turnbull, Consulting Engineer.

Activated Sludge 'Pakage' Plants Consistently Specified by Sanitary Engineers

for

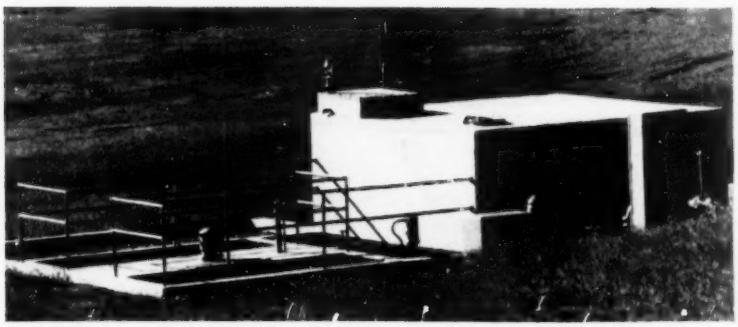
- **SMALL COMMUNITIES**
- **INDUSTRIAL PLANTS**
- **AIRPORTS**
- **HOSPITALS, SCHOOLS and OTHER INSTITUTIONS**

Activated Sludge 'Pakage' Plants have a proven 19 year record for producing sparkling clear effluent.

Many semi-automatic features simplify operation and assure trouble-free performance under all conditions. 'Pakage' Plants can be operated by men with State Board of Health minimum classification.

Aeration and clarification are accomplished in a single tank with positive sludge control that covers a wide range of sewage flows and strengths.

'Pakage' Plants handle sewage flows of from 1500 to 500,000 gallons per day in single or multiple units, and may be safely located near dwellings, as the clear effluent produced is free of flies, foul odors and unsightly appearances.



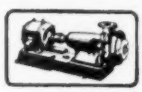
Activated Sludge 'Pakage' Plant at Contra Costa, Jr. College, Contra Costa, California. This 7' unit is designed to treat 15,000 gallons per day. Roy E. Ramseier, Consulting Engineer.

Specify Activated Sludge 'Pakage' Plants for proven and trouble-free sewage disposal performance.

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

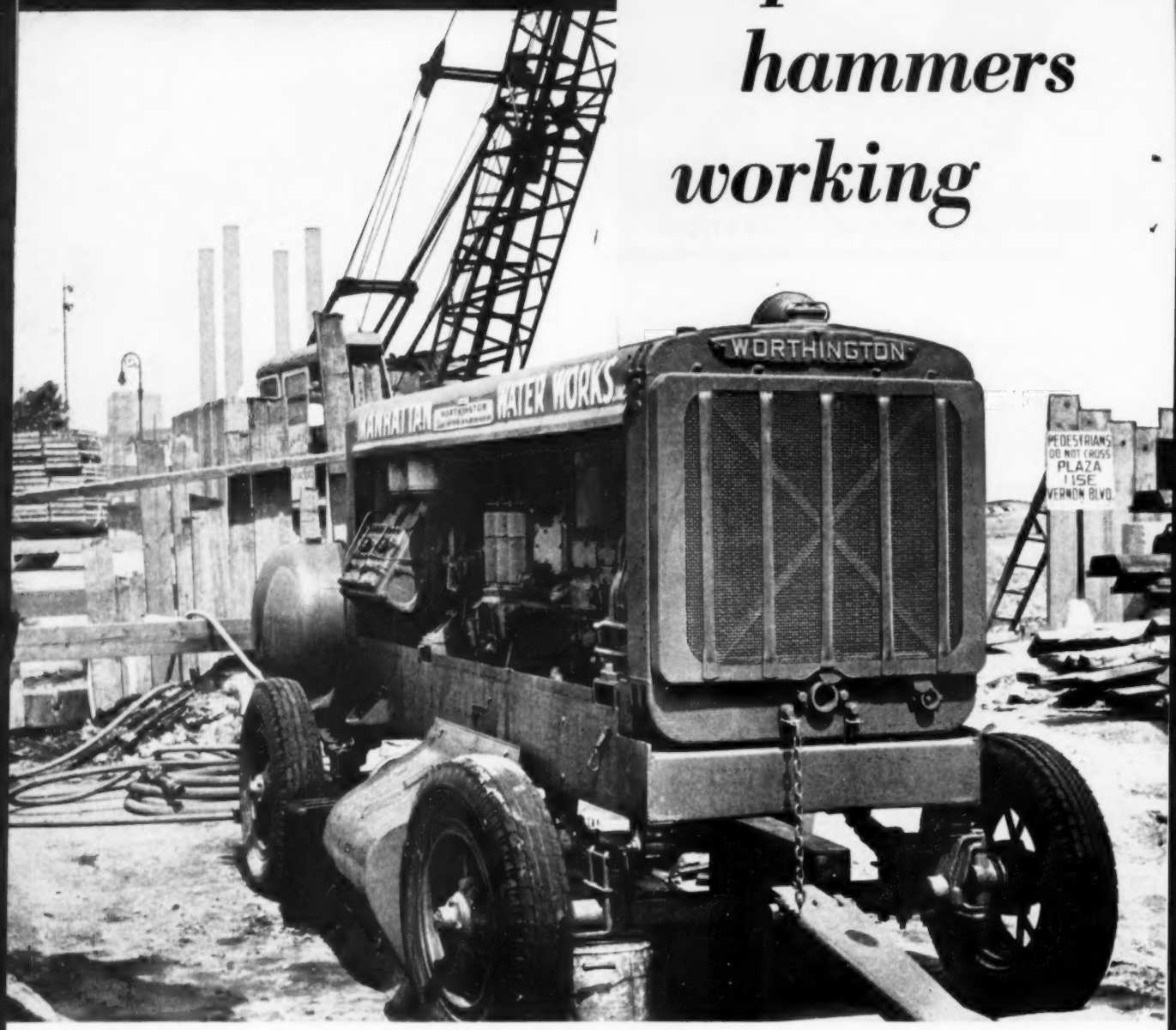
622 DIVERSEY PARKWAY — **CHICAGO 14, ILLINOIS**



Flush Kleen, Screw Peller, Plunger Horizontal and Vertical Non-Clogs Water Seal Pumping Units, Samplers

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

CAT* POWER *keeps the hammers working*



This 500 CFM Worthington compressor is one of two powered by Caterpillar D13000 Diesel Engines, supplying air to six jack hammers and a pile hammer on a pipe-laying job by Manhattan Water Works, Inc., Bronx, N. Y. The job involves excavating 20,000 yards of earth in laying 3400 feet of steel water pipe and 2100 feet of concrete sewer pipe.

"We chose Caterpillar power for our compressors because of the service we have seen them give on other jobs," says William H. Walker, Project Engineer. The work is part of the new Brooklyn-Queens improvement program. The engine pictured uses from 25 to 30 gallons of fuel during its eight-hour work day. Like all Cat Diesels, it is designed to give foul-free performance on low-cost No. 2 furnace oil.

Leading manufacturers of air compressors and excavators can supply these engines in their equipment. Specify Cat power and you can count on long life, low maintenance and years of trouble-free operation. Or if you need replacement power, see your Caterpillar Dealer. He has the right engine for your job, in one of 12 sizes up to 500 HP.

Caterpillar Tractor Co., Peoria, Illinois.

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SPECIFY CAT POWER FOR HIGH-PROFIT PERFORMANCE

THE MOST USEFUL ENGINEERING MAGAZINE

PUBLIC WORKS

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CONTENTS FOR OCTOBER, 1953

PUBLIC WORKS DIGESTS

DEPARTMENTS AND SECTIONS

NBP CCA

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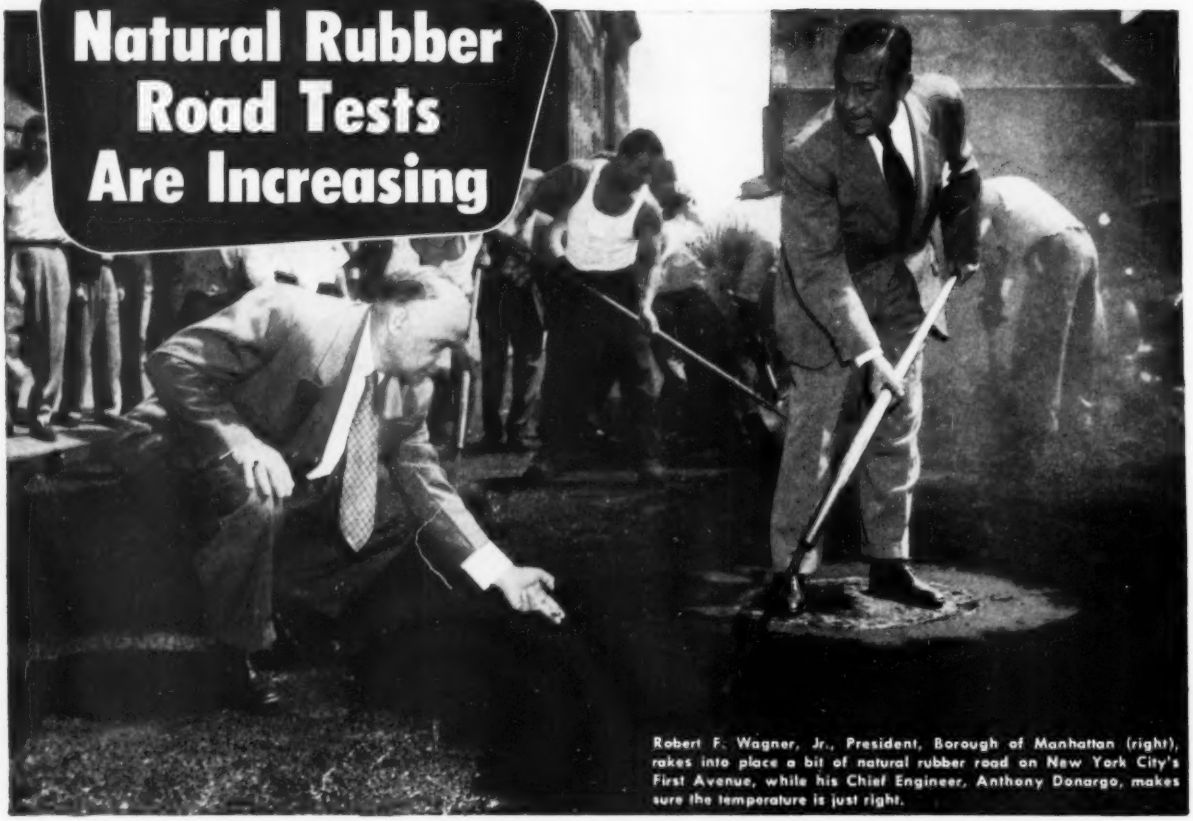
Natural Rubber Road Tests Are Increasing



Robert F. Wagner, Jr., President, Borough of Manhattan (right), rakes into place a bit of natural rubber road on New York City's First Avenue, while his Chief Engineer, Anthony Donargo, makes sure the temperature is just right.

3 Field Engineers Added to NRB Staff to Aid Test Progress

To meet the increasing need for technical assistance in planning and in laying test natural rubber roads, the Natural Rubber Bureau has added three field engineers to its staff of road experts.

All three are experienced highway engineers who have recently gone through an intensive training course on the application of natural rubber powder in highway construction at the Bureau's Research Laboratory.

Many communities throughout the country are laying block-long test sections of natural rubber-asphalt paving so that their highway engineers can study the effects of local traffic and climate conditions. These tests may lead ultimately to substantial savings of taxpayers' dollars, by pointing the way to roads which will last longer and require less maintenance.

The Natural Rubber Bureau offers free information and technical assistance to all highway officials who wish to lay test roads incorporating natural rubber.

Natural Rubber Bureau

1631 K Street, N. W., Washington 6, D. C.

Natural Rubber Bureau Research Laboratory, Rosslyn, Virginia

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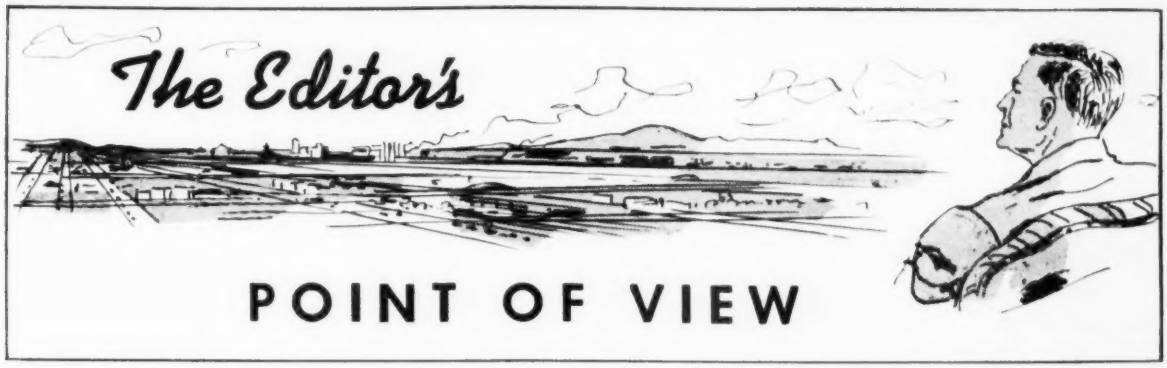


More Problems for Engineers to Solve: And More Opportunities

ENGINEERS need not go very far in their search for more worlds to conquer, for there are plenty of man-sized jobs waiting to be done—jobs that engineers are best qualified to do. We refer primarily to such things as the reconstruction of our under-sized road system to carry the traffic loads of today; the problems of sewage and industrial waste treatment; refuse collection and disposal; and water procurement and utilization.

No special comment is necessary on the road situation. Anyone who drives an automobile has first-hand information on this. In regard to industrial waste, we have just made a survey of nearly a thousand cities to determine the industrial plants producing waste which need some kind of pretreatment; and there is plenty to be done. Subdivisions present a difficult, but not insoluble, problem in sewage disposal. The development of new sources of water supply and the procurement of greater quantities of water offer a problem which challenges every engineer. A new deal, too, is needed in refuse collection where the utilization of labor-saving equipment and methods has been painfully slow.

It is a good thing, now and then, to survey the problems and the opportunities ahead; and then to get ready to buckle down and do them. The nicest thing about engineering is that our problems are also our opportunities; and that there are always plenty of both.

Highway "Litterbugs" Cost Plenty in Terms of More Roads

EVERYONE who travels our main highways after a holiday or week-end knows that the collection and disposal of the trash thrown from cars by careless motorists must cost something. Well it does: And that something is over $100,000 per year in several states. The Missouri State Highway Department says it spends $190,000 per year for road-side clean-up and that it could build about 30 miles of farm-to-market road or 11 miles of asphaltic concrete resurfacing with that money.

It would be well worth while to start a campaign to inform the general public how their money is being wasted by a careless few. This could involve signs, newspaper articles, radio talks, and the other resources of a public relations program. Service clubs could be encouraged to help; the young could be reached through the schools, Scouts, 4H Clubs, and similar channels.

Such a campaign need not be expensive and could reduce the clean-up costs materially. Also, it might well be a starting place for some of those public relations programs that so many engineering organizations really need though usually they hate to admit it.

Traffic Accidents and Violations Point to Highway Lacks

FIGURES on traffic accidents and arrests for traffic violations in Bergen County, N. J., one of the so-called "bedrooms" of New York City, are illuminating. This is a populous and growing county in the northern part of the state. During July, 1953, 43 traffic accidents were reported. Of these, 27 were rear-end accidents and 11 were so-called "cut-off" accidents. Both of these are characteristic of inadequate and overcrowded highways. During the same month 529 summonses were issued for traffic violations, of which 200 were for passing on the road shoulders and 74 others were for violations generally associated with unsafe congestion.

Something Can be Done About Highway Accidents

LAST YEAR the people in Nebraska became alarmed at the mounting toll of deaths on the highways. They decided to do something about it and initiated a campaign aimed at motor vehicle drivers. Fourteen counties in southwestern Iowa joined them. What happened? Let's look at the record. For the year, traffic deaths per 100,000 persons in the surrounding states were: Wyoming 18.4; South Dakota 16.4; Kansas 25.9; Colorado 16.7; and in the Iowa counties outside the campaign area 16.4. What was it in Nebraska and the fourteen Iowa counties covered in the campaign? Only 14.3.

Here a campaign to educate the drivers, rather than advocating changes in the highway system, produced tangible results quickly. Any community can do the same.

Making the best still better

Sounds impossible, doesn't it . . . improving the cast iron pressure pipe that has served so many communities so long and so faithfully?

But the fact remains: today's modernized cast iron pipe is better than ever . . . stronger, tougher, more uniform in quality . . . even more economical and efficient than the cast iron pressure pipe that serves . . . and has served . . . for centuries.

And that is exactly what today's *modernized* cast iron pipe offers the waterworks industry. Cast centrifugally for greater strength and toughness. And, where needed and specified, cement-lined centrifugally for sustained carrying capacity and freedom from tuberculation.

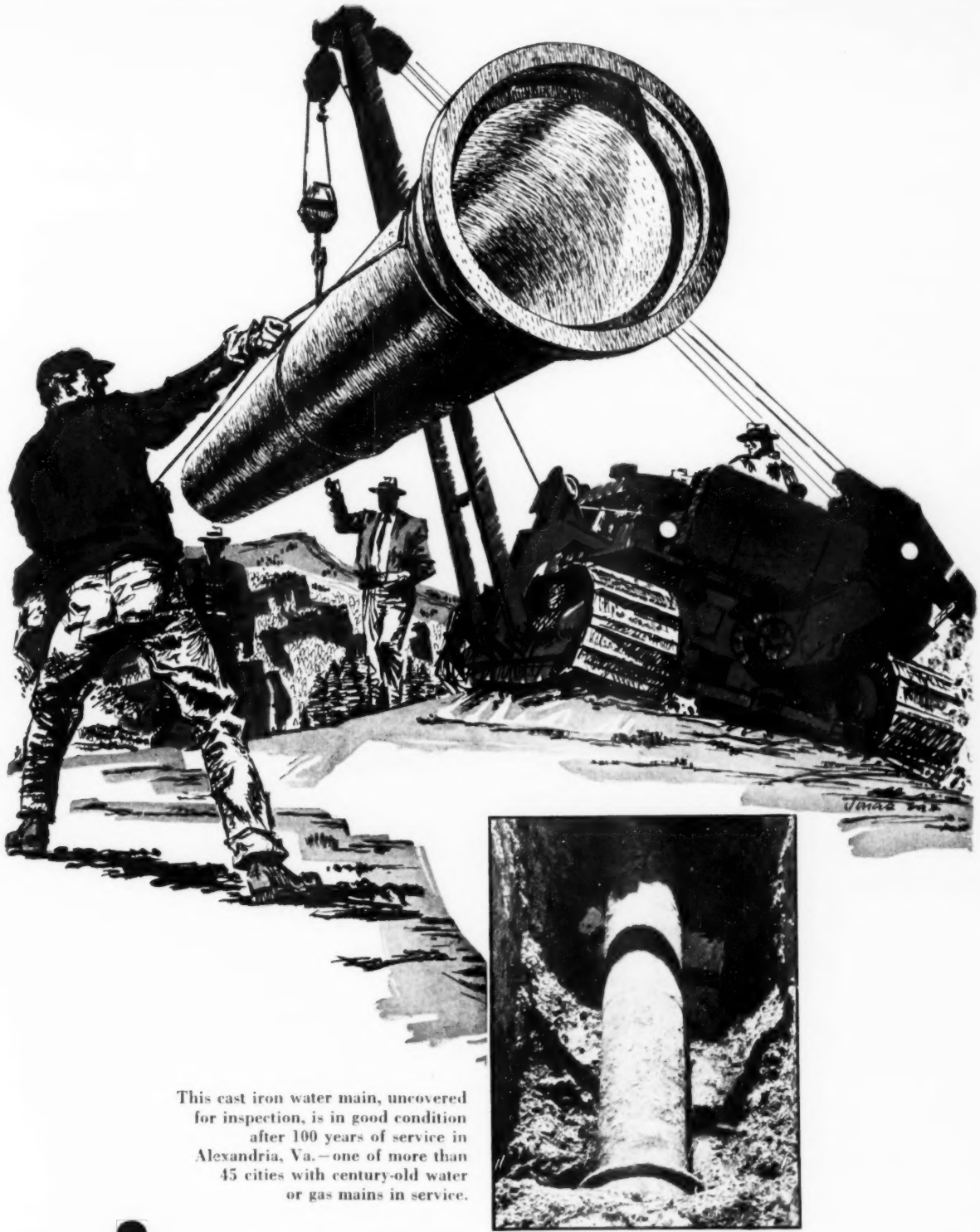
If you want the most efficient and economical pipe ever made for water distribution, your new mains will be laid with *modernized* cast iron pipe with either bell-and-spigot or mechanical joints. Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Ave., Chicago 3.

CAST IRON

The Q-Check stencilled on pipe is the Registered Service Mark of the Cast Iron Pipe Research Association.

Modernized **cast iron**

Now's the time to mail this month's Reader's Service card.



This cast iron water main, uncovered for inspection, is in good condition after 100 years of service in Alexandria, Va.—one of more than 45 cities with century-old water or gas mains in service.

pipe *for Modern Waterworks Operation*

Need more facts about advertised products? Mail your Readers' Service card now.

The Finest Equipment For Efficient ICE CONTROL!...

The Improved **BAUGHMAN** *Hydraulic* **SPREAD-MOBILE**

- ONE-MAN OPERATION
- COMPLETELY CAB CONTROLLED
- SPREADS 300-3300 LBS. PER MILE

Exclusive "CENTER-SPRED" DESIGN gives VISIBLE SPREAD...POSITIVE TRACTION

✓ **COMPLETE HYDRAULIC OPERATION**

Both *width* and *amount* of material spread are now controlled right from the truck cab. This is achieved by two independently operated hydraulic motors. One drives the drag chain (the speed of which controls the amount of material). The other drives the distributor (the speed of which determines the width of spread).

✓ **NEW IMPROVED "CENTER-SPRED" PATTERN**

Located between front and back wheels on driver's side, the distributor spreads material *in front* of all four wheels. Result: perfect traction for Spread-Mobile, complete visibility and control of spread. Baffles can be added to control spread so it is predominantly to the driver's side or curb side.

✓ **ADAPTABLE TO YEAR 'ROUND OPERATION**

The Spread-Mobile can be used for ice-control in winter; in summer for such road maintenance work as oil-blotting, shoulder maintenance, etc.

HEAVY-DUTY POWER UNIT

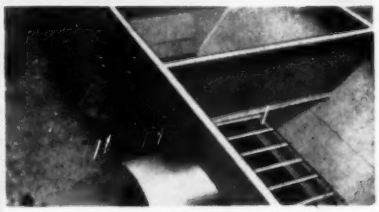
Including 14-hp T.F. Wisconsin Gas Engine with all controls in truck cab.

EXCLUSIVE EXHAUST HEAT PREVENTS FREEZING

Patented chamber utilizes exhaust heat; prevents load freezing, aids penetration.

SPLIT-BOTTOM DUMP ADDS USEFULNESS

Adaptable in off-season periods to many of the functions of general dump body.

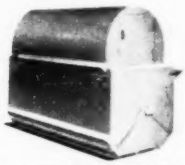


Write for Bulletin No. 370-H

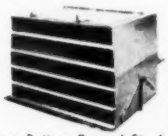
BAUGHMAN MANUFACTURING CO., Inc.
220 ARCH STREET • JERSEYVILLE, ILLINOIS

Get full details of this month's products . . . mail your Readers' Service card today.

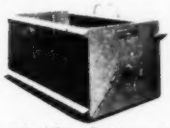
Universal Type Container is available in 4 to 12 cu. yd. capacities with or without top lids.



Apartment Type is available in 4 to 10 cu. yd. capacities. Note Sump Bottom, also available in Universal, Standard Drop Bottom and Drop Bottom Pressed Steel Type containers, for handling moist rubbish.



Drop Bottom Pressed Steel is available in 5 to 10 cu. yd. capacities without or with top lids.



Standard Drop Bottom, available in 2 to 10 cu. yd. capacities, is ideal for many materials handling uses.

Tilt Type, with two top lids, is available in 2 to 7½ cu. yd. capacities.

Multi-Karry Container comprises a master 6 cu. yd. container with three 2 cu. yd. box-like containers on casters. Each of the 2 cu. yd. containers may be rolled to a trash accumulation point. When loaded they are returned to master container and all three taken to dump and emptied by truck-mounted Dempster-Dumpster.

See us at Booth A-28
Public Works Show
October 26-29
New Orleans

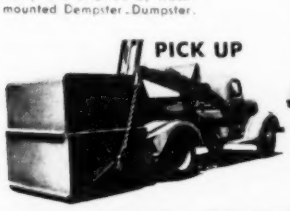
You will Dump High Costs, too

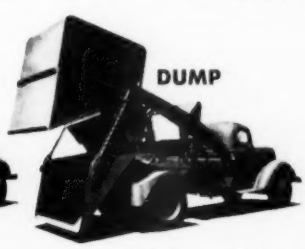
. . . when you install the Dempster-Dumpster System of Trash and Rubbish Collection

Cities over the nation have learned to eliminate the costly and inefficient method of handling trash and rubbish with conventional trucks, drivers and loading crews. You can equip one truck with a hydraulically operated Dempster-Dumpster. This truck-mounted Dempster-Dumpster, with only one man, the driver, serves scores of detachable Dempster-Dumpster Containers, as shown below. These containers replace unsanitary and unsightly trash cans, barrels, crates, etc. at such places as hotels, schools, hospitals, restaurants, department and grocery stores, market and housing areas, etc. Each is loaded by the user. By pre-arranged schedule your truck-mounted Dempster-Dumpster picks up, hauls and dumps each container—one after another.

We show at left a few of the popular designs being used. One Dempster-Dumpster handles them all, regardless of design or size. Containers built for handling trash and rubbish have doors or lids, permitting contents to be sealed up and eliminating rats, flies and the scattering of refuse by winds and scavengers.

You eliminate trucks standing idle. You eliminate re-handling of trash and rubbish. You eliminate loading crews. You increase efficiency, sanitation and city-wide cleanliness with this Dempster-Dumpster System —the lowest cost method of trash and rubbish collection ever devised. Write to us for complete information. Manufactured exclusively by Dempster Brothers, Inc.





THE DEMPSTER DUMPSTER SYSTEM

DEMPSTER BROTHERS, 9103 Dempster Bldg., Knoxville 17, Tennessee

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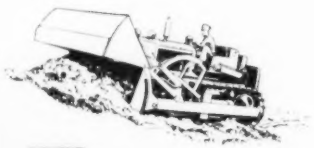
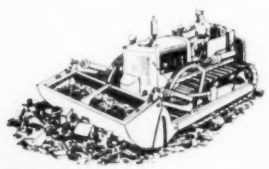
How to Stop Erosion

GARBAGE IN A GULLY. All Wewoka's garbage is hauled to gullied farmland at outskirts where the Crawler-Bullclam Unit pushes it into eroded areas, crushes and compacts it and then applies sealer coat of earth.

PASTURES MADE TO ORDER. Final earth cover is applied by Bullclam as a 14-foot erosion scar is leveled and readied for use as valuable pastureland.



1. Prepares the site



2. Crushes and compacts refuse

Thousands use our Readers' Service card to keep up to date . . . do you?

with City Waste

Wewoka, Oklahoma, turns gullied wasteland into lush pastures with an International Crawler-Drott Bullclam Unit

Lifelong residents of Wewoka, Oklahoma, are finding it difficult to locate the city dump —even when they are standing right on it— since the Drott Bullclam Sanitary Fill Method of garbage disposal has been adopted.

There was no mystery about the location of the garbage dump prior to the summer of 1951. Fact is, residents got plenty riled up over smelling burning garbage and voted favorably on a bond issue. City officials then purchased an International TD-14A crawler with Drott Bullclam along with two modern garbage trucks and started the landfill garbage disposal method.

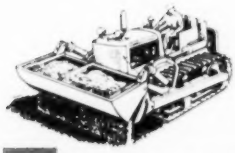
Today Wewoka waste is being used to stop erosion on farmland near the outskirts. Garbage is trucked to the edge of the gullies where the TD-14A-and-Bullclam takes over. It spreads and compacts the refuse beneath the specially-curved Bullclam blade. Then it carries the covering topsoil and spreads it in place. Finally the filled gullies are graded smooth and the wasteland can be planted for lush grazing.

Olen Arnold, in charge of the dump fill, reports: *"Now we have a dump to be proud of. Residents come out and can't find the dump when they are actually standing on top of it. That's quite a contrast to the complaints we used to get when garbage was burned and odors, rats and flies were a by-product. Everybody here is well-pleased with the way the International-Drott unit is working out after eight months."*

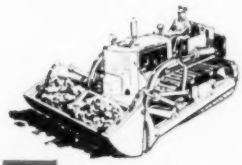
The Drott Bullclam Sanitary Fill Method of waste disposal is being used by more and more communities for three big reasons: 1) it provides municipal health insurance at low cost; 2) it's nuisance-free; and 3) it offers unlimited possibilities for converting wasteland into parks, factory sites or residential tracts. Get further details from your International Industrial Distributor. Or write:

DROTT MANUFACTURING CORP., MILWAUKEE 8, WISCONSIN
INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILLINOIS

See this equipment at the Public Works Show, October 26-29



3. Transports and spreads earth cover



4. Grades and levels, finishes area

BULLCLAM BY

DROTT

POWER BY

INTERNATIONAL

INTERNATIONAL HARVESTER

POWER THAT PAYS

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If it's concrete . . .

UNIVERSAL

world's largest manufacturer of concrete sewer and culvert pipe

can make it

26 plants for convenient, economical service.

30 years' experience in pipe, cribbing, precast manholes, riverweights, flat base pipe. Name it, we make it!

UNIVERSAL
CONCRETE PIPE CO.
297 South High Street
Columbus, Ohio
Publishers of Famous "Pipe Dreams"

UP FRONT FOR ADEQUATE ROADS

BY
LEO J. RITTER, JR.

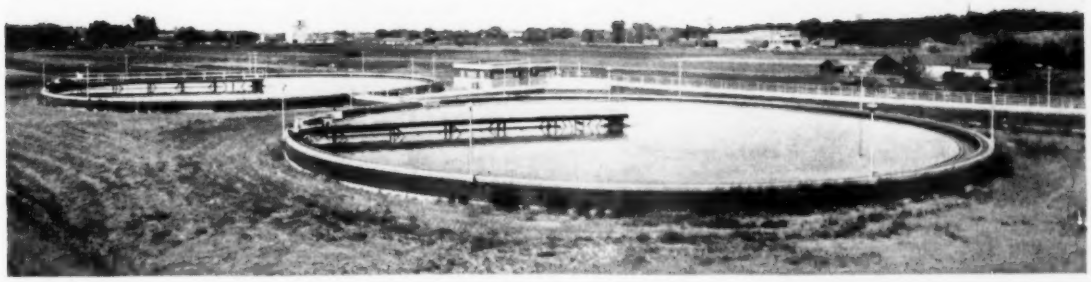
The District — Spent a couple of typically torrid days late in August in Washington with the objective, among a few other things, of picking up some hot (no pun intended) dope on developments in the highway field. Didn't seem to have too much luck, though—maybe the weather was just too hot. Did get to spend an hour or so with Walt Johnson at the Highway Research Board. Walt is soils and foundations engineer for the Board and is one of the best people in the country in this phase of highway engineering. It has been his untiring effort which has lead to many of the fine publications of the Board about soils, including the widely used bulletins on compaction and frost action. Also spent a few minutes with Mr. Lang of the Division of Maintenance of the Bureau of Public Roads and with Frank Turner, who has done such a tremendous job in handling the foreign program of the BPR. Official information about changes in the Bureau's organization and activities under the new commissioner is becoming available slowly. It is possible that activities of Bureau personnel in the AASHO will be sharply curtailed, which may have a considerable effect upon the activities of this group's technical committees. Most of the talk that I heard in Washington about highways was about finance and planning, planning and finance, ad infinitum.

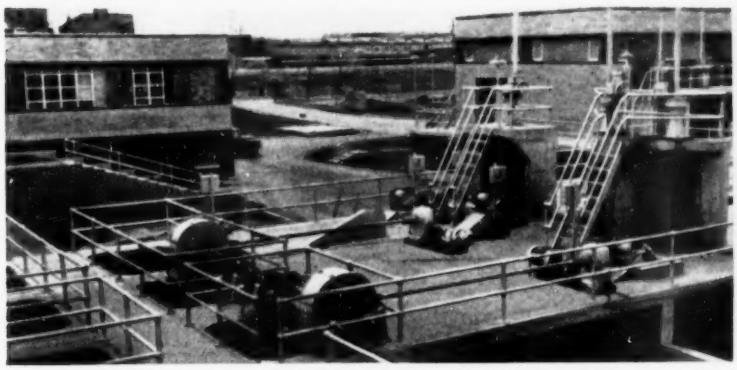
Technical Bulletins—The American Road Builders Association has recently released a group of seven technical bulletins embracing a variety of subjects. Included among them is one entitled "Curing Slippery Pavements" by George Martin, Highway Consultant to PUBLIC WORKS. Information about these bulletins may be obtained from ARBA, 918 Sixteenth St., N. W., Washington 6.

Stabilization — An announcement in the Florida Municipal Record of a $50,000 paving program being undertaken by the City of Jacksonville Beach brings to mind the fun we had with an experimental soil stabilization project in that resort town in the winter of 1950-51. The project was carried out under the auspices of the Florida Engineering and Industrial Experiment Station and involved the improvement to two city blocks. A laboratory-designed mixture was evolved using coquina shell dreged from the beach, local "sugar sand" (a clean, fine, uniform sand) and less than 5 per cent cutback asphalt (RC-1). This mixture was laid on top of an existing shell-stabilized subgrade; depth of the surface averaged between 4 and 5 inches. Despite curing difficulties because of wet and cold weather (apologies to the Chamber of Commerce), the mixture finished out in good shape and has been carrying moderate traffic with no signs of distress, even though it had not even had a seal coat the last time I saw it. At the time, the cost of this treatment on a contract basis would have been less than 60 cents per square yard. Big man behind this cooperative effort was "Mac" McCotter, currently City Manager. The overall point, of course, is that many local materials can be used successfully in stabilization, requiring only a little ingenuity and investigation. The whole concept of soil stabilization is most important in relation to lightly traveled local roads and city streets, particularly in residential areas. It's a favorite topic of ours and maybe we can cover it in more detail in a later issue.

Air-Entrained Concrete — We were much interested in a report (Bulletin No. 70, Highway Research Board) by L. E. Andrews of the Portland Cement Association about the service record of experimental sections of concrete pavement in 5 northeastern states. These sections

(*Continued on page* 141)





Link-Belt Circuline sludge collectors, mechanically-cleaned bar screens and Straightline grit collector help provide 114 mgd peak load capacity at Denver sewage treatment plant. Black & Veatch, Consulting Engineers.

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LINK-BELT screens, sludge and grit collectors chosen for the job

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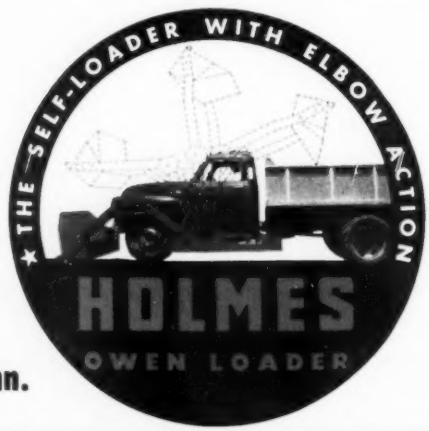

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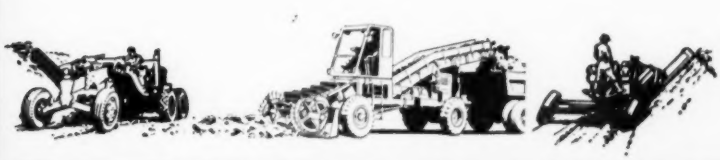

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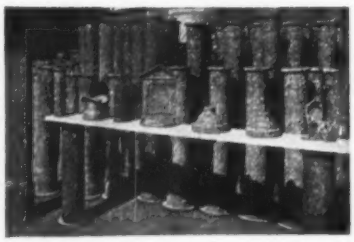

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People, Ideas and Events

BY "DOC" SYMONS

H.T.M.A. — And here it is October, the month of the FSIWA; this year in Miami. Even before it occurs, I take my hat off to the local arrangements committee members and their work—and I speak as one who has gone through it.

★ ★ ★

Coffee and Kringle — One of the non-technical highlights of past FSIWA meetings has been Chain Belt's "Coffee and Kringle" parties. I recently ran across the card invitation they issued at the St. Paul meeting in 1951. On the back, in strange handwriting, was this pencilled notation: "Negro Spiritual; Soon I will be done with the troubles of de world, going home to God."—I'm curious; I wonder who wrote that note, and why.

★ ★ ★

Swedefinition—"Census is the population of the country broken down by age and sex."

★ ★ ★

Speaking of the census; I suppose you all read recently that the U.S. population reached 160,000,000. I hope all you water and sewage superintendents, consulting engineers, and equipment manufacturers know what this means to the future of our business—and remember that census figure grows by the minute.

★ ★ ★

Names Make News — Richard (Dick) Hazen, busy young consulting engineer in New York, not only is active in AWWA (Program Chairman), ASCE, and other technical organizations, but he finds time for civic work as chairman of a Study Committee for the Famous Childrens' Village in Dobbs Ferry, N.Y.

★ ★ ★

Small World No. 21—I went to a wedding as a "friend of the bride," and later talked with the groom's father, Wendell Kleindienst, whom I had met but once. Conversation got onto the subject of universities and he mentioned Stevens Institute as his Alma Mater. Right away, I said I had a friend who was a graduate of Stevens; name of George Kelsey, Pres. of Builders-Providence.—Kleindienst replied quickly, "We were classmates." I also discovered that Kleindienst once sold Everson Sterelators.—Small World!

★ ★ ★

I Read Somewhere — Sodium Gluconate has been employed successfully as a sequestering agent in preventing insoluble calcium and magnesium salt from hard water.—Competition for Calgon? ? ?

★ ★ ★

Johnny Kleinhenz, Publicity Director for Indianapolis Water Co., edits a neat company house organ, called "Water Lines." A recent issue told of a conscientious taxpayer who wrote the city fathers: "Water fountain in Ellenberger Park has a continuous waste of water. . .should have a check valve or something."—The fountain is a flowing artesian well which costs the city nothing for the water.

That reminds me of the story told by "Bill" Brush, AWWA's perennial treasurer, and onetime Chief Engr. of New York City's Water Supply.—Many consumers in an area in the Bronx walked blocks to fill jugs from that "wonderful spring in the park"; but the spring dried up when the water department repaired a leak in the water main.

★ ★ ★

Luminous Quote—"To approach a problem, after you have decided to solve it, is different than to approach it to see if it can be solved."—Anon.

★ ★ ★

La Guardia Was First — Now that *Time, Tide, People Today,* the *Associated Press,* the *AWWA Jour.* and various independent newspapers from Boston to L.A. have commented on the Teleflush method of rating TV programs, it's about time to point out that it was George

(*Continued on page* 159)

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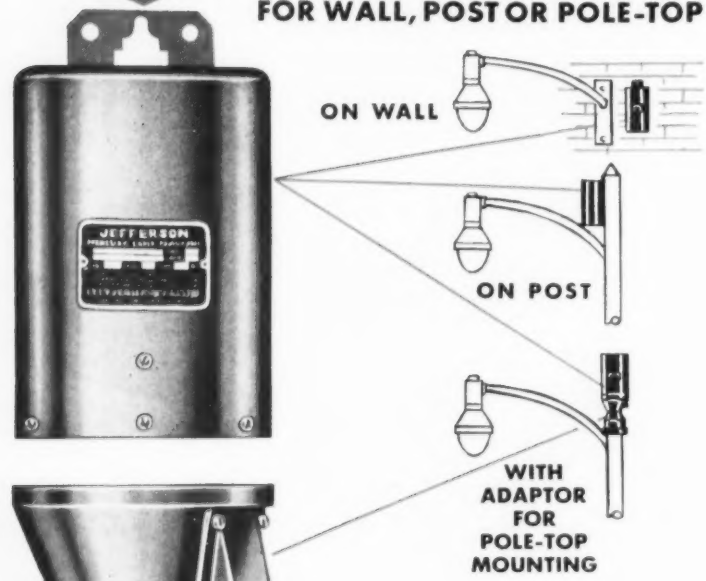

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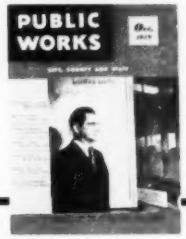

LEADERS IN PUBLIC WORKS

Soulé Butler is City Engineer of Alexandria, Louisiana. He graduated from Louisiana State University in 1927 with the Degree of Bachelor of Civil Engineering and in 1935 with the Degree of Civil Engineer. Prior to his present position, which he has held since 1944, he was employed by the Bridge Department of the Louisiana Department of Highways (from 1927 to 1941), except for three years which he spent with the Bridge Department of the Arkansas Highway Department. At the beginning of World War II, he entered the service in the Corps of Engineers and was employed principally on airport construction in connection with the military construction build-up program.

His duties with the city include the supervision of design and construction of municipal utilities, street paving and public buildings. He is also technical advisor for the City Council. During his eight years with the city he has been responsible for the construction of millions of dollars of major improvements.

Mr. Butler is a member of various civic organizations and engineering societies, including ASCE, NSPE, AWWA, APWA, and FSIWA. He is Vice-President of the Municipal and Airport Division, ARBA, and a member of the Louisiana Engineering Society and of the American Society of Military Engineers.

He is married to the former Frances Thornton of Mansfield, La., and they have two daughters. Stamp collecting, hunting and fishing are his hobbies.

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May 14, 1953

180

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1. Universal use of the unit on all types of collection service at maximum efficiency. Unit can be assigned to any collection route whether on straight ashes, garbage or mixed refuse. This flexibility of assignment is especially important in the light of the extension of the incinerator program and the separation of ashes.

2. Due to a smaller hopper opening there is less spillage both on the part of the loaders and as a result of winds. Likewise the operation is more sanitary since the loaders are not exposed to the refuse and odors as is the case on a batch-type large hopper.

3. Batch-type unit is a single purpose truck for mixed material and not fully satisfactory for straight collection of ashes.

4. As a continuous loader, the escalator compactor unit daily payload performance is greater than the batch-type unit.

5. During a comparable nine month period of the term of the manufacturer's guarantee on the latest deliveries of 210 escalator-type and 140 batch-type units the average percentage of lost days due to repairs to days assigned to district garages in the case of the escalator-unit equalled only 1.8% while for the batch-type the average percentage was 19.5%.

6. The Consulting Engineers employed by the Mayor's Committee on Management Survey to study the operations of the Department of Sanitation recommended that the escalator-compactor type collection truck become the standard collection unit for future purchases.

7. It is the Department of Sanitation's intention to standardize its refuse collection truck fleet on the escalator type...

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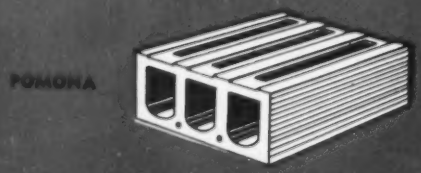
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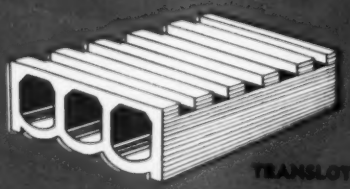
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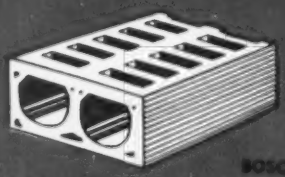
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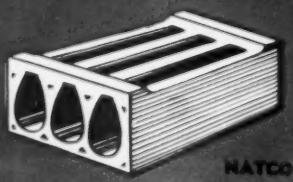
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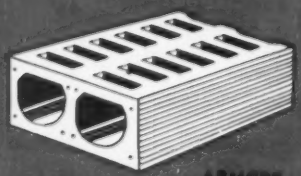
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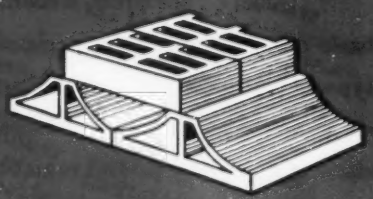
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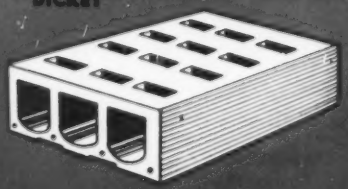

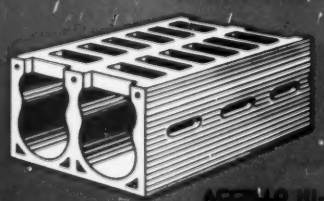
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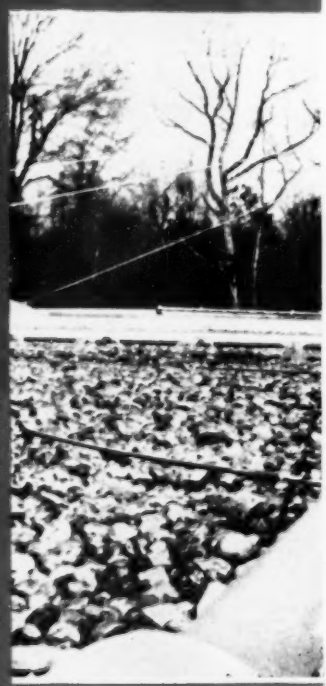

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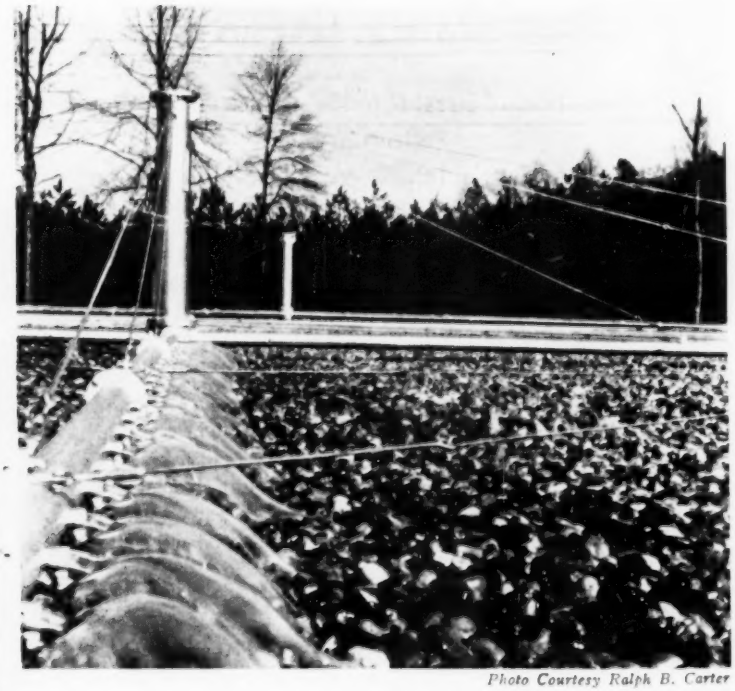

Photo Courtesy Ralph B. Carter

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PUBLIC WORKS for August, 1953

HOW WE GET "FLORIDA" STREETS IN THE WINTER

FRANK F. HARMON
Commissioner of Public Works, Syracuse, N. Y.

SNOW plowing and ice control are only two of the problems of taking care of winter streets, but they are probably the most important to a community as far as safety and maneuverability are concerned. Of the two, ice is normally the greater hazard, but with the change in design of automobiles, with high-[illegible] motors and much less

four; and some only two. In all, we estimate that we have 1600 miles of street lanes that must be plowed after each snow storm; and we have allocated our equipment on the basis of five miles an hour effective plowing.

We do not start plowing until there is a minimum of three inches of snow; but [illegible] start salting im-

Although we had more snow this year up to March 10 than in the previous year, it fell mostly in storms of less than three inches in depth. With our salting program we had very little plowing to do on our heavy traveled highways.

Let me tell you briefly of our organization for handling snow and ice in Syracuse. The Commissioner assumes the [illegible]

"We start salting immediately, using nothing but pure salt . . . no abrasive."

Model SS-5E

Syracuse—Baltimore—New York City—Nashville — Toronto — Denver — Milwaukee and dozens of other progressive cities, state highway departments, and villages **use the frugal "Scotchman" for slippery pavements.**

The "Scotchman's" metered, "bird-shot" spread is the CHEAPEST and FASTEST way to bare, safe pavements. **50% CHEAPER—8 TIMES FASTER.** It seems like magic after having used sand or cinders.

You and the driving public, will be delighted with your clean, bare streets. And you'll be especially pleased at the money you save using fast and thrifty "Scotchman" spreaders.

"Scotchman"-applied Salt Saves: TIME, MONEY and LIVES.

Booths #41 & 42, American Public Works Show, New Orleans, La.

TARRANT Manufacturing Company
27 Jumel St., Saratoga Springs, N. Y.

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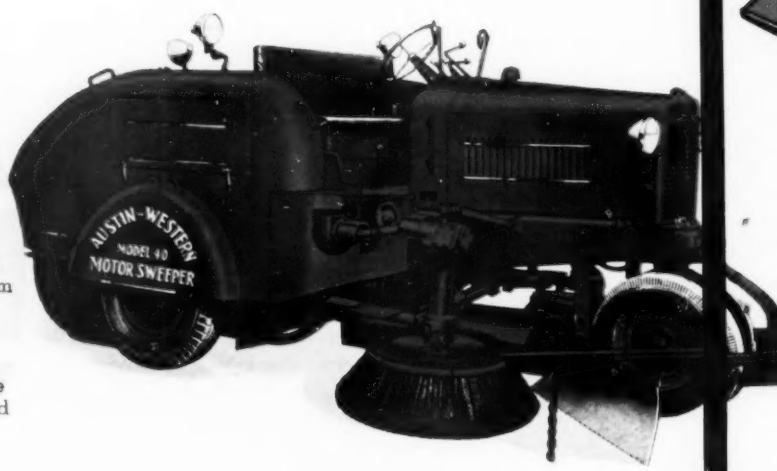
feature packed performance around the clock!



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Road Rollers • Hydraulic Cranes

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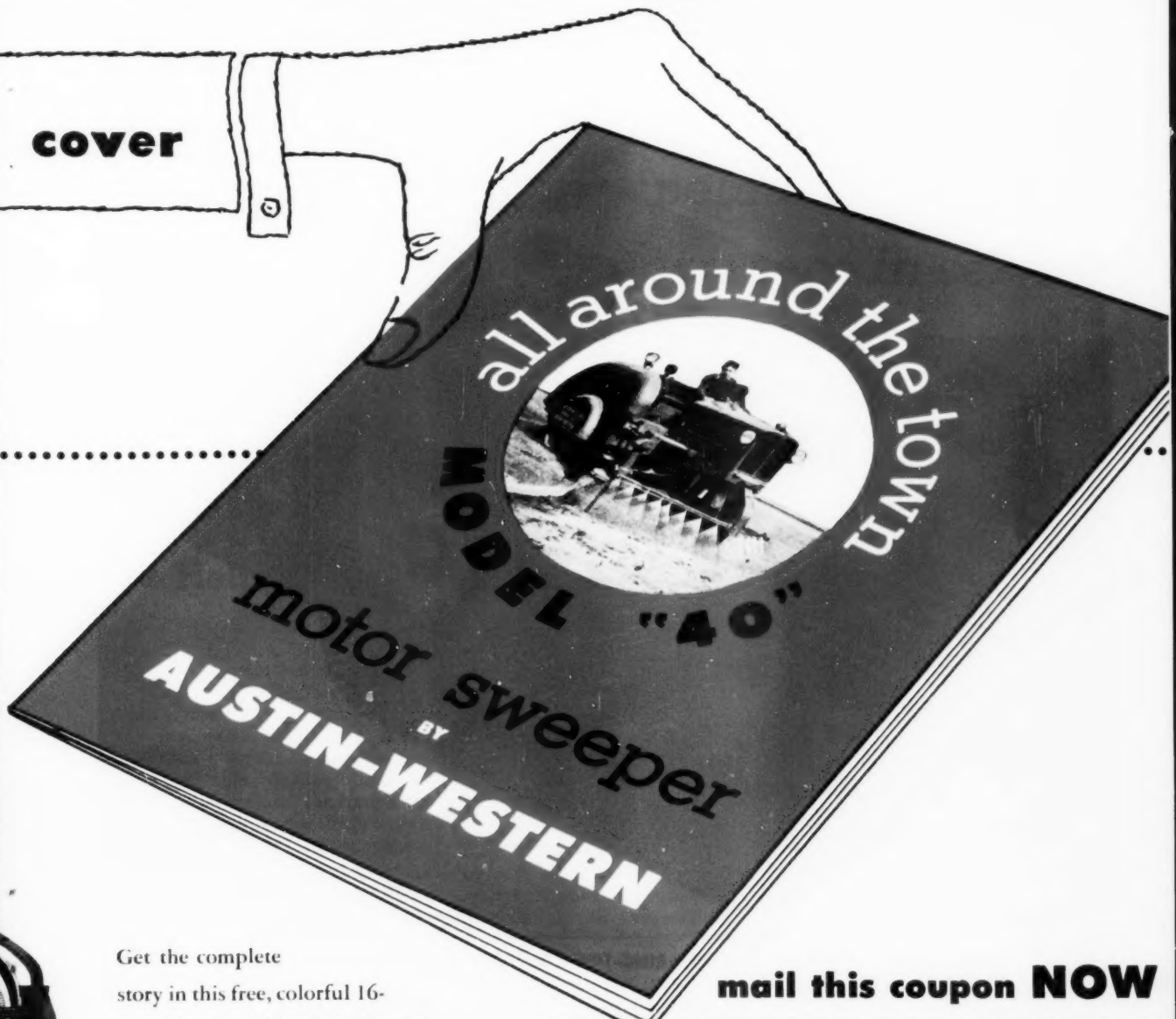

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Read the facts and prove to yourself why the Model "40" is the sweeper that has "what it takes" including a combination of features found in no other sweeper in the world.

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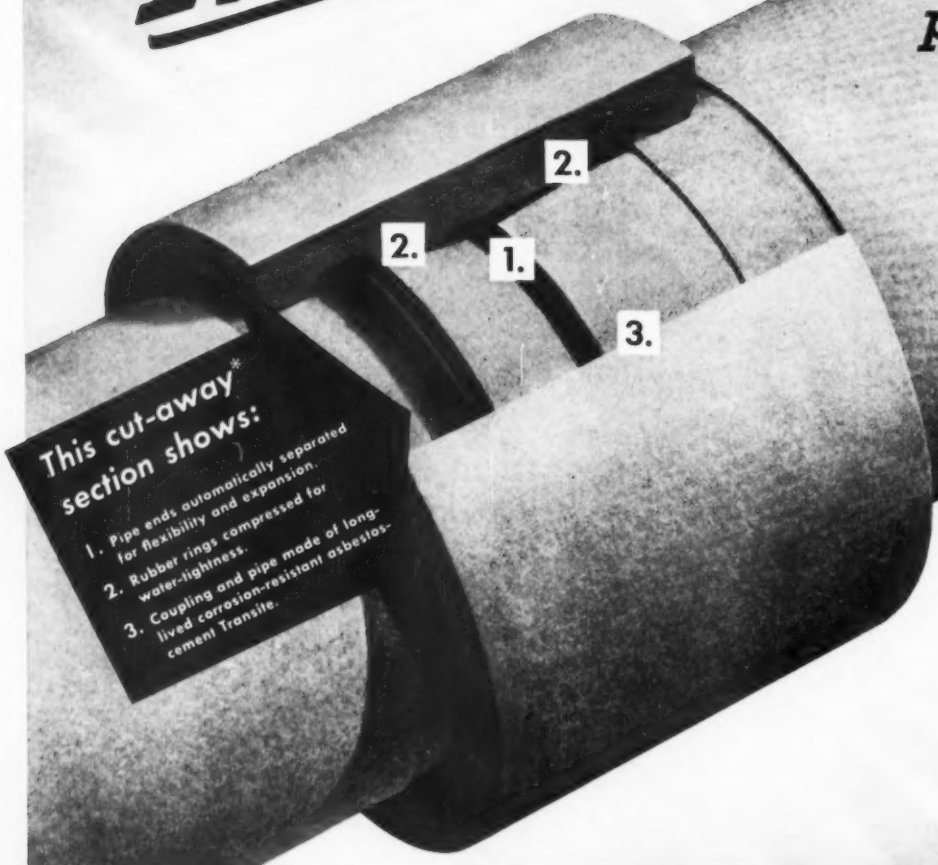


This cut-away* section shows:

1. Pipe ends automatically separated for flexibility and expansion.
2. Rubber rings compressed for water-tightness.
3. Coupling and pipe made of long-lived corrosion-resistant asbestos-cement Transite.

INSTALLATION OF TRANSITE RING-TITE COUPLING IS SURE, SIMPLE, EASY

A. Rubber rings in groove before assembly

B. Rubber rings compressed after assembly

* **NOTE:** In the large photograph above, a portion of the Ring-Tite Coupling has been removed to show its design. One rubber ring has been cut to illustrate how it is compressed between pipe and coupling.

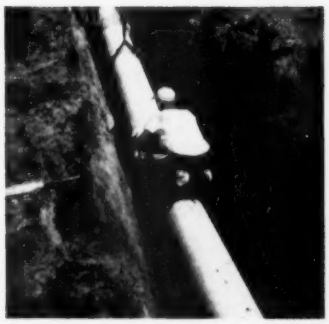
Johns-Manville

Get full details of this month's products . . . mail your Readers' Service card today.

RING-TITE® Coupling

greater economy in pipeline installation ... maximum performance in service

- **Simplifies Transite Pressure Pipe assembly**
- **Reduces installation time**
- **Helps assure tight, flexible joints**



Here on this 12" New England installation of the Ring-Tite Coupling, the contractor's bid was based on installing 400 feet per working day for the job conditions prevailing. Actual laying time averaged over 700 feet per day!

Because of its unique design, the new Johns-Manville Ring-Tite Coupling provides many money-saving advantages. For example, no complicated equipment is required for line assembly. With tight, flexible Ring-Tite joints easily obtained, the contractor can get in and get out quickly with a substantial saving of time and money.

Ring-Tite Coupling installations can be made under adverse weather, temperature, or terrain conditions. Loose sand, slippery clay, mud and ice do not interrupt pipe assembly nor affect the performance of the completed assembly. Transite Pressure Pipe and Ring-Tite Couplings can be assembled in wet trenches.

Rings automatically positioned and locked in place

Pipes need only rough aligning. The coupling does the rest automatically . . . centers, aligns and adjusts for expansion. Rings are automatically pre-positioned by simply "popping" them into prepared grooves . . . and when the pipe is being pulled, the sliding motion of the rings squeegees all loose foreign material from the end of the pipe.

Each Ring-Tite Coupling is automatically stopped in exactly the correct sealing position to assure maximum water tightness and joint flexibility . . . to permit conformance to curves . . . to withstand shock and vibration . . . to relieve line stresses.

As a long-term investment, Transite Pressure Pipe effects outstanding performance and economies in your water supply and distribution expansion programs. Now the Ring-Tite Coupling brings you equally substantial *installation* economies—*immediate* savings!

For further information, write Johns-Manville, Box 60, New York 16, N. Y.

Actual experience on this New Jersey installation by a prominent water works utility established entirely new concepts of installation savings effected by the Ring-Tite Coupling. On the job shown, 600 feet of pipe were laid in 5 hours.

TRANSITE PRESSURE PIPE

JOHNS MANVILLE PRODUCTS

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NEW LISTINGS

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the coupon, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field.

Learn About the Pipeline-Network Analyzer

43. The McIlroy pipeline-network analyzer for rapid calculation of flow rates and head losses caused by fluid friction is described and illustrated in Bulletin 183 of the Standard Electric Time Co., 59 Logan St., Springfield 2, Mass. A discussion of applications, results and costs, and a helpful page of questions and answers are included. Check the coupon for your copy.

New Roto-Pac Features Speed Refuse Collection

50. Features of the Roto-Pac refuse collection unit, which include automatic continuous loading and packing, with increased power to provide for larger loads in the same size body, are described in bulletins issued by City Tank Corp., 53-09 97th Pl., Corona, L. I., N. Y. Check the coupon now to learn how your collection problems can be eased.

Check the Jobs You Can Do With the Roustabout

57. The Hughes-Keenan Roustabout, available in three models to meet your needs, will handle an endless number of jobs such as lifting and installing heavy valves, fittings and motors, laying pipe, handling sand and other materials with a bucket, loading, towing, etc. Get full data by writing Hughes-Keenan Corp., 640 Newman St., Delaware, Ohio, or check the coupon.

Bury Your Bridges To Make Them Better

127. Replacing obsolete bridges no longer need be a slow, expensive operation. In a new bulletin, Armco Drainage & Metal Products, Inc., Middletown, Ohio, says "Bury your Bridges to Make Them Better." This well illustrated bulletin shows how corrugated metal structures forestall obsolescence, provide ample strength and are quickly installed. Check the coupon for your copy.

Uniform Salt and Cinder Spreading at All Speeds

93. Be sure to investigate the hydraulically operated ground drive offered by Baughman to give you the advantages of two drive speeds and uniform distribution of material regardless of truck speed, but without the need for power takeoff or transmission. Full data on this and many other features in Form A-380. Baughman Mfg. Co., Jerseyville, Ill.

Be Sure to Check Your Tractor Shovel Needs

94. A comprehensive 16-page catalog now available from Frank G. Hough Co., 761 Seventh St., Libertyville, Ill., shows how cities, counties, contractors and others use the Model HR four-wheel drive Payloader on earth and material handling jobs. Be sure to check the way you could use this machine. Get Form No. 225 by checking the coupon.

Helpful Data On Outdoor Lighting Equipment

63. A complete catalog of standard Union Metal brackets, mast arms and accessory attachments for poles of every type, and including mounting instructions and illustrated construction details is now available from Union Metal Mfg. Co., Canton 5, Ohio. Get this important reference booklet by writing to the company, or check the coupon.

Economical Answer to Leaf Raking Problem

77. The Turbo-Jet Power Leaf Mill makes it easy to get neat, leaf-free grounds; gets hard to reach places; sucks up leaves and pulverizes them into a fine mulch; does the work of ten men with rakes. For full data use the coupon or write Turbo Jet Mfg. Co., 22 Bowman Terr., Cincinnati 29, Ohio.

New Economy in Brush Clearing Work

78. Quick, effective brush cutting with the Brushmaster saw lets one man do the work of six when clearing brush for highway departments, on watersheds, along right-of-ways. Brambles, briers, vines, bushes, brush and saplings up to 4" dia. are easily cut with this lightweight, powerful tool. For full data check the coupon. Brushmaster Saw, Inc., 89 Emerald St., Keene, N. H.

What You Should Know About Soil Sampling

79. A complete line of soil sampling tools for hand and power operation are fully described and illustrated in Bulletin No. 25, issued by Acker Drill Co., Inc., Scranton 3, Pa. Applications of each type of tool are indicated. Get your copy by checking the coupon.

How a Reservoir Leakage Problem Was Overcome

103. The use of Laycold Weathercoat to form an impervious membrane in the construction of an excavated reservoir is the subject of an interesting bulletin offered by American Bitumuls & Asphalt Co., 200 Bush St., San Francisco 4, Calif. Construction details for typical jobs are included. Check the coupon for your copy.

MORE LISTINGS ON PAGES 34 TO 52

New Mechanical Compression Refuse Collection Unit

128. The Packa-Van garbage collection truck body compresses entire body contents with 35,000 pound force to haul more per load; square body permits shorter length; ram unloads contents quickly and completely without tilting body. For full details get illustrated bulletin by checking coupon. Brown Truck & Trailer Mfg. Co., P. O. Box 1281, Charlotte, N. C.

Guide to Selection and Use Of Portable Heaters

133. In a cleverly written yet comprehensive booklet prepared by Herman Nelson Div., American Air Filter Co., Inc., Moline, Ill., the authors point out that safety to personnel and protection from fire hazards, as well as heat output and portability are major factors to consider in the selection of portable air heaters. You'll find all the facts in this 36-page booklet. Check the coupon for your copy.

10-53

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on products and materials mentioned in this issue. Circle numbers below and mail today.

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New Products, pages 161 to 165:

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NEW LISTINGS (Cont.)

Data Offered on Refuse Incineration

134. Fully illustrated 8-page bulletin which describes all components of mechanically stoked incinerators for municipal refuse is offered by Morse Boulger Destructor Co., New York 17, N. Y. Typical layouts of single and duplex units are included. Get helpful Bulletin 111B by checking the coupon.

Cut Resurfacing Costs With Manhole Adapters

137. There is a WB "Manhole Adapter" to fit every street opening and for varying elevations to suit your resurfacing job. Be sure to check this way to maintain structural strength, reduce traffic interference and save time and labor. Get full data from WB "Manhole Adapter", 1320 McGee St., Kansas City 6, Mo. Check the coupon.

Portable Compound Pots With Bottled Gas Burners

146. For added convenience, Aeroil portable compound pots and lead melting furnaces are offered with bottled gas burners as well as kerosene burners. Get data on melting pots and kettles for all types of jointing materials from Aeroil Products Co., 19 Wesley St., So. Hackensack, N. J. Check the coupon.

Soil-Cement Information: Short-Cut Testing Procedures

159. A 12-page booklet entitled "Short-Cut Soil Cement Testing Procedures for Sandy Soils" is now available from the Portland Cement Assn., 33 W. Grand Ave., Chicago 10, Ill. Charts in the booklet are planned to reduce laboratory work for the scientific testing and control procedures developed by PCA. Get your copy by checking the coupon.

What You Should Know About Steel Reservoirs and Standpipes

163. In a handsome 24-page booklet "Horton Steel Reservoirs and Standpipes," the Chicago Bridge & Iron Co., Chicago 4, Ill., shows installations from 50,000-gal. to 10,000,000-gal. capacity with several types of roof and special architectural features. Engineering data includes information on capacities, foundations and improved surface protection. Check the coupon to get your copy.

The Calculating Machine You Carry in Your Pocket

125. Weighing but 8 ounces, the Curta Calculator adds, subtracts, multiplies, divides, cubes and gives square roots. Fits easily in the hand and combines versatility of large desk calculator with convenience of slide rule. Get full details from Curta Calculator Co., 3851 W. Madison St., Chicago 24, Ill. by checking the coupon.

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CIVIL DEFENSE

Get the Facts on Air Raid Sirens

86. There's more to be considered in air raid warning sirens than the loudness of the signal. Get complete information on efficient size and spacing of sirens from Federal Enterprises, Inc., 8733 So. State St., Chicago, Ill., by using coupon.

Are You Ready Now To Make Main Repairs?

214. Broken water mains can quickly be repaired when you have "Skinner-Seal" Split Coupling Clamps on hand. Get Skinner Catalog 41 now—this handsome 40-page book shows how to make every type of pipe repair and covers a complete line of clamps to do the job quickly and easily. Just check the handy coupon for your copy. M. B. Skinner & Co., So. Bend 21, Ind.

Does Your Water Works Have Standby Power?

224. Dependable Climax power plants are ready for emergency service to insure fire protection, and can also save power costs by peak load operation. Use the coupon for full data on Climax, 40 to 495 HP, operating on sewage or natural gas, butane or gasoline. Climax Engine & Pump Mfg. Co., 208 So. La Salle St., Chicago 3, Ill.

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REFUSE COLLECTION AND DISPOSAL

Quel—For Control Of Garbage Odors

27. A new product, Quel, is offered to stop odors from garbage and waste. A small quantity of this liquid is said to sanitize garbage containers, kill maggots, repel flies and other pests. Get full details from W. B. Farrell, Inc., 1960 Opdyke Rd., Pontiac, Mich. Check the coupon.

Increasing the Efficiency of Bulk Rubbish Collection

177. Strategically spotted bulk containers can be handled by one man operating a Dempster-Dumpster equipped truck. Get full details of this cost-saving system of rubbish collection, as used by many cities to increase efficiency and eliminate unsanitary conditions. Write Dempster Brothers, Inc., 952 Dempster Bldg., Knoxville 17, Tenn., or use the handy coupon.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 8, Wis. Get your copy by checking the coupon; you'll find this booklet both interesting and valuable.

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Traffic-stopper . . . sales-builder! This 100 x 160-foot Butler building gives the Shult Implement Company, El Campo, Texas, a sales "showcase" with permanent, low-cost space for displays, offices, parts and service departments.

This main street beauty is a "showcase" BUTLER steel building

Traffic slows as drivers take a second look. Folks on foot pause to browse and stay to buy. The cash registers never seem to stop "talking." Yes, the eye-catching beauty of this modern store—that's a Butler steel building at heart—does more than tickle the owner's vanity. It actually increases store traffic—sales and profits!

You, too, can profit by doing business in a building that's an attractive "showcase" for your merchandise. You don't have to be made of money, either. You can get costly custom-built beauty at mass production prices by combining a regular Butler building with wood, masonry, and glass. Your architect can economically create the individuality that coaxes more customers inside.

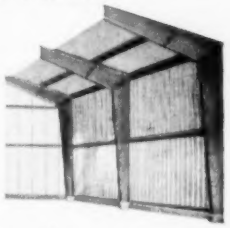
Butler buildings provide post-free interiors for shops, stores or offices that are 100 per cent usable. They can be economically heated—insulated for year-around comfort. Insurance rates are low.

You don't need a big bankroll to own a beautiful shop or store, tailored to your individual needs. Write today for full details and the name of your nearby Butler dealer!

Here is why BUTLER is a better buy

Every Foot of Floor Space is Usable

There are no interior posts or columns to waste space and create work-slowing "bottlenecks." Rigid-frame construction also shrinks maintenance costs . . . extends building life.



Fast Erection . . . Easy Expansion

Precision-punched and dimensioned bolt holes speed erection—simplify expansion or dismantling and moving. Galvanized bolts, with Neoprene rubber washers, lock deep-corrugated sheets firmly to the sturdy frame.

Weatherproof Protection

The one-piece, die-formed roof ridge eliminates ridge roll—helps to make the building leakproof and weather-tight.

Triple-Strength Corrugated Sheets

Butler sheeting, with deep-drawn corrugations formed on 12-inch centers, is three times as strong as ordinary corrugated sheets. Overlapping corrugations bolt tightly together for maximum strength and weather protection. Available in steel or aluminum.

Attractive Curved Eaves

The neat, die-formed eaves—which bolt to the roof sheets—add to the appearance of Butler steel buildings . . . increase the strength of the eaves . . . help insure weather-tightness.

Weather-sealed Windows and Base

Where corrugated sheets meet windows or the foundation, they are tightly crimped for a snug fit that keeps out snow, moisture and rodents.

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To order these helpful booklets check the coupon on page 32.

Sanitary Landfill Operation and Methods

28. The location and area requirements for sanitary landfill, operation methods for trench type and area fills, equipment selection and costs are items discussed in an 8-page booklet issued by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis. Be sure you have this reference when considering the problem of garbage and refuse disposal. Check the handy coupon today.

What You Should Know About Refuse Incinerators

58. Two helpful bulletins tell what you should know about low cost refuse incineration for the small community and for larger cities. Your questions on mechanical stoking, burning rates and operating problems are discussed. Get Bulletins 217 and 223 from Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y. Just check the coupon.

Efficient Material Handling to Reduce Incineration Costs

130. Blaw-Knox Buckets specially designed for refuse and garbage handling are described in 22-page Bulletin 2350. Illustrations show progress of material through a modern municipal incinerator plant. Dimensions and incinerator bucket specifications are included. Blaw-Knox Div., 2124 Farmers Bank Bldg., Pittsburgh 22, Pa.

Thinking of Sanitary Landfills? Get This Booklet Now

131. One of the most informative descriptions of the sanitary landfill method of garbage and refuse disposal is presented in Caterpillar's 16-page booklet "A Look to the Future with Sanitary Landfill." The booklet is designed to serve as a guide to proper site selections, the choice of the right equipment to do the job, and the actual operations of sanitary fill. Pictorial treatment shows how and when to start such a program, what to look for in a site, benefits received by the community, and other important considerations. Published by the Caterpillar Tractor Co., Peoria 8, Ill. Check the coupon for your copy.

Get Greater Efficiency on Garbage and Refuse Pick-Up

340. Reduced pick-up costs for garbage and refuse collection are claimed with use of the Quad-O-Matic Loader. High-capacity body carries big loads and reduces number of trips to disposal point. Four loading buckets operate independently and distribute load evenly. Hydraulic controls. For more details get bulletin by checking coupon. Equipment Mfg. Co., Dept. PW, 2155 Hoover Rd., Detroit 5, Mich.

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SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay underdrain blocks conforming to ASTM standards, suggestions for layout and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute, c/o Editor, Public Works, 310 E. 45th St., New York 17, N. Y. Check the coupon and we will forward your request.

Floatless Liquid Level Controls

92. Complete descriptions of electrode type floatless liquid level control systems, including control units, electrodes and fittings, panel assemblies and diagrams of typical installations for all types of municipal service are covered in the 32-page catalog of Charles F. Warrick Co., 1956 W. Eleven Mile Rd., Berkley, Mich. Check coupon for your copy.

Forms for Every Concrete Pipe Shape

95. In addition to this a complete line of forms for standard concrete sewer and drainage pipe, special forms for varied shapes of every type are listed in the Quinn Concrete Forms Catalog. Copies available by checking the coupon, or write direct to Quinn Wire and Iron Works, 1621 12th St., Boone, Iowa.

Valuable Booklet on Porous Diffuser Plates and Tubes

21. A helpful 20-page booklet published by the Norton Co. is a complete guide for the selection of porous media for installation in activated sludge plants. Full data for the designing engineer is provided by careful detailing of physical characteristics of plates and tubes. Maintenance of porous media also is discussed at some length. For your copy of Form 1246, write the Norton Co., Dept. PW, Worcester 6, Mass., or use the coupon.

How Cities Clean Sewer Lines From Street in One Operation

25. In a helpful 28-page handbook of sewer cleaning methods and equipment the makers of OK Champion sewer cleaners give full details of power and hand operated models. Also included are data on expansion buckets that take dirt from sewer to street in one operation, root cutters and other accessories. Get your copy by checking coupon. Champion Corp., 4752 Sheffield Ave., Hammond, Ind.

Design Data Offered On The Spiragester

42. The Spiragester, a unit which combines the Spiraflo Clarifier and a digestion compartment in a two-level arrangement to save space and reduce construction costs, is fully described in Bulletin 124 released by Lakeside Engineering Corp., 222 West Adams, Chicago, Ill. Design details, including capacities for 8' to 24' units are furnished together with typical plan and elevation. Check the coupon for this helpful bulletin.

A Handbook of Sewer Cleaning Methods and Materials

44. Complete, easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 40-page booklet issued by Flexible Sewer-Rod Equipment Co., 9059 Venice Blvd., Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SeweRodeR, hand tools and all accessories. Water main and culvert cleaning methods are included. Check the coupon for your copy of this helpful handbook.

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reduces needle spinning to an absolute minimum by the introduction of subsidiary magnetic fields which create a powerful electric "braking" action. PINPOINT ACCURACY WITH GREATER SPEED — fewer man hours on every job!

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THE New AQUA VALVE BOX LOCATOR

New engineering design, perfected after two years of research and now built into the AQUA at no additional cost to you MEANS ABSOLUTE MINIMUM OF NEEDLE-SPINNING ACTION!

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Here a city-owned Hydrocrane excavates for water mains. Quick-set outriggers provide outstanding machine stability—even permit the ⅜-yd. clamshell bucket to be handled with standard boom in horizontal position.

Every Hydrocrane operation is fully hydraulic—swing, line hoist, boom telescope, boom hoist, bucket close, outrigger set and retract.

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High Rate Filters For Sewage Treatment

74. Accelerated biological oxidation in treatment of sewage and other organic wastes is a feature of Infilco's Accelo Filter system. Bulletin 6200 explains the direct recirculation principle, shows plant layouts, and gives performance data. For your copy write Infilco Inc., Box 5033, Tucson, Ariz., or check handy coupon.

Helpful Design Data For Sewage Ejectors

81. The applications and advantages of pneumatic sewage ejectors are outlined in a new bulletin of the Blackburn Smith Mfg. Co., Inc., Hoboken, N. J. Included are piping diagrams for electrode and float switch controls plus dimensions and layouts for single and duplex systems. Get your copy by checking coupon.

Porous Media Handbook For Sanitary Engineers

222. A really helpful 56-page booklet just published by the Carborundum Company tells the complete story of the use of porous media in the fields of water and sewage treatment. The major portions are devoted to water filtration and air diffusion for activated sludge treatment. Diagrams show the many installation methods used, and full data is provided for the designing engineer. General data and specification sections complete this valuable reference bulletin. Get Form 5118 by checking coupon or write The Carborundum Co., Refractories Div., Perth Amboy, N. J.

Data Offered on Water, Sewage and Waste Treatment Equipment

263. Equipment for sewage treatment, water purification and industrial waste treatment is described in a 16-page Book No. 2440, published by Link-Belt Co., Colmar, Pa. Case histories, photographs and schematic drawings are included. Straightline and Circuline collectors, Thru-Clean and Straightline bar screens, Tritor screens, flash mixers, scum breakers and other units are described. Check the coupon for your copy.

End Roof Problems With Root-Proof Sewers

107. Troubles caused by roots and corrosions in house connections can be eliminated by the use of root-proof Bermico sewer pipe. Full details on this smooth, waterproof, tight-sealing pipe available by checking the coupon, or write to the Brown Co., Dept. PW, 150 Causeway St., Boston 14, Mass.

Comminutors for Automatic Disposal of Coarse Sewage Solids

152. The problems connected with disposal of coarse sewage solids are eliminated by clean, odorless, automatic Comminutors. Full engineering data show the proper model for every size plant and furnish details of hydraulics and typical installations. Chicago Pump Co., 622 Diversey Pkwy., Chicago 14, Ill.

How Vacuum Filters Help Your Sewage Sludge Disposal

209. Applications of the Conkey sludge filter to all types of sewage sludge are described in Bulletin 100. Tables show filter sizes, weights, and give anticipated average results. Use the coupon to order your copy. General American Transportation Corp., Process Equip. Div., New York 17, N. Y.

Book Tells How to Control Root Stoppages

249. Details on the proven use of copper sulfate to control root and fungous growths in sewers are contained in a brand-new book published by Phelps Dodge Refining Co., 40 Wall St., New York 5, N. Y.

Get the Facts on The Contact Aeration Process

303. Full engineering details on the submerged contact aeration process of sewage treatment, including diagrams of plant units, area requirements, operating costs and other details are available in a bulletin of the Hays Process Co., Box 768, Waco, Texas. Check the coupon to get the facts.

Designing Grit Chambers? Here's What You Should Know

113. A helpful bulletin filled with drawings of typical designs, operating data, clearly written text outlining the principles of grit chamber design and requirements for removal of grit free from organics is offered by the Dorr Company. Get your copy of Bulletin 6411 on the Dorr "Detritor" by checking the coupon or from the Dorr Co., Barry Pl., Stamford, Conn.

Non-Clogging Vertical Wet-Pit Pump Described

182. Full engineering data on Worthington "Freeflo" wet-pit pumps with non-clogging impellers capable of passing solids and stringy material are included in Bulletin W-317-B12. Check these pumps for sump, sewage and drainage service. Bulletin available from Worthington Corp., Harrison, N. J. Just use the coupon.

Complete Catalog for Engineers Shows Water and Sewage Plant Equipment

191. The complete line of Jeffrey equipment for treatment of water, sewage and industrial wastes is covered in 52-page Catalog 833. Detailed information is provided on bar screens, grinders, grit collectors, "Jigrit" washers, sludge collectors, feeders, conveyors and other related units. Photos and drawings of installations plus capacity tables complete this valuable booklet. Use coupon or write Jeffrey Mfg. Co., 947 N. 4th St., Columbus 16, Ohio.

Efficient Blowers for Activated Sludge Plants

232. Many advantages of Roots-Connersville positive displacement rotary blowers are described in Bulletin 22-23-B-13, which also provides characteristic curves for operation with constant speed, multi-speed and variable speed motors and details of several types of blowers. Get this helpful bulletin by checking the coupon. Roots-Connersville Blower Corp., Connersville, Ind.

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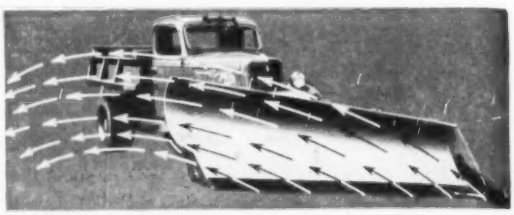

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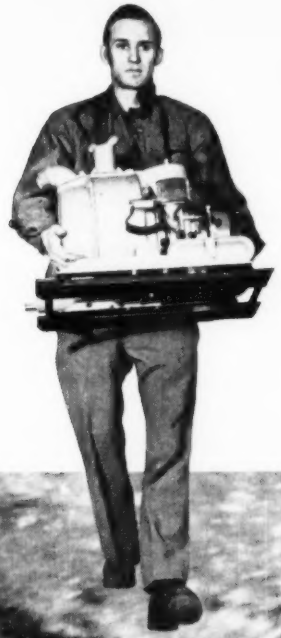

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174. Description of operating principles and application of B/W controls show the simplicity and many uses of these all-electric, floatless devices. Get latest bulletin for engineering data, diagrams of typical installations and details of component parts. Check the coupon or write B/W Controller Corp., Dept. PW, Birmingham, Mich.

General Catalog on Measuring and Controlling Equipment

272. The full line of Simplex equipment for the measurement and control of liquids and gases in water and sewage plant installations is illustrated and described in detail in 28-page Catalog 003. Every engineer should study the design data in this helpful booklet. Write Simplex Valve & Meter Co., 68th & Uplands Sts., Philadelphia 42, Pa., or use the coupon.

How to Dispose of Sewage and Industrial Sludges

281. Get full information on the C. E. Raymond System of combined incineration and sludge drying providing high temperature deodorizing for nuisance-free sludge disposal. Flexible layouts fit large and small communities. Use handy coupon or write Combustion Engineering Inc., Flash Dryer Div., 200 Madison Ave., New York 16, N. Y.

STREET LIGHTING

Mercury Vapor Lights Need Efficient Transformers

225. To get all the benefits of mercury vapor lamp illumination, efficient transformers are required. Complete data on Jefferson Transformers for all outdoor and indoor installations is offered in 16-page illustrated Bulletin 521-5 by Jefferson Electric Co., Bellwood, Ill. Particular attention is given to street lighting applications. Get a copy now by checking the coupon.

WATER WORKS

Check List for Proposed Water Supply Lines

24. A convenient folder covering all the requirements for proposed water supply lines has been prepared by Price Brothers Co., 1932 East Monument Ave., Dayton 1, Ohio. Basic questions about the materials you plan to use are arranged for easy evaluation of each type of pipe material. Get a copy of this useful folder by checking the coupon.

Head Loss Data On Plastic Pipe

26. Carlon Products Corp., 10225 Meech Ave., Cleveland 5, Ohio, announces that authoritative data has been compiled on head loss due to friction in Carlon plastic pipe and is available in the form of graphs and charts. The graphs show superior flow characteristics, attributed to the fact that plastic pipe is not "wetted" by water. Send for this data today by using the handy coupon.

Water Level Controls for Sewage and Water Plants

31. Dependable float-operated pump and motorized valve controls for single or multiple pump installations are described in bulletins issued by the Water Level Controls Div., Healy-Ruff Co., 719 Hampden Ave., St. Paul 4, Minn. All units feature splash proof construction, mercury tube switches.

Data on Cutting-In Valves, Repair Sleeves and Accessories

33. A variety of Clow products for installation and repair of cast iron pipe lines, including the Eddy cutting-in valve and sleeve, split sleeves for pipe repair, test plugs, valve boxes, Strickler pipe cutters and other fittings and accessories are featured in literature available from James B. Clow & Sons, Inc., Box 6600-A, Chicago 80, Ill. Check the coupon.

Technical Data on Fluorides And Other Chemicals

48. Technical data on fluorides and other chemicals will be found in a comprehensive booklet issued by Blockson Chemical Co., Joliet, Ill. This helpful 60-page booklet includes a great deal of general information of value to water works men. Get a copy by checking the coupon.

Painting Water Tanks For Longer Protection

52. High labor costs demand special consideration when painting elevated water tanks. This and other factors involved in proper paint selection are discussed in a bulletin issued by Jos. Dixon Crucible Co., Jersey City 3, N. J. Helpful specifications for repainting water tanks are also included. Check the coupon today.

Theory and Application Of the Flow Tube

84. Hydraulic formulae, head capacity curves and test data for this primary metering element are given in a technical bulletin, "Theory and Application of the Flow Tube," available from Foster Engineering Co., Union, N. J. Check the coupon for a copy.

Methods of Chlorinator Control

98. Chlorinator control methods include manual, semi-automatic, program, rate, fully automatic proportional and split feed control. To assist the chlorinator user and his engineer or technical adviser in the selection of the control method best suited for each requirement, a publication of Wallace & Tiernan, Inc., describes these methods in detail. You can get a copy of Publication TA-1013-C by checking the coupon.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa

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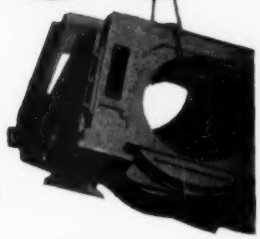

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Useful Data on Butterfly Valves

100. Complete descriptions and tables of dimensions on the full line of Rockwell Butterfly Valves is contained in several bulletins published by the company. Construction details and special control features are illustrated. Write W. S. Rockwell Co., 200 Eliot Street, Fairfield, Conn.

How to Tap Concrete Pressure Pipe

126. The simple steps required in making a pressure tap in concrete pressure pipe are explained in a booklet issued by Lock Joint Pipe Company. Be sure you know how either large connections or small service outlets may be made economically and without sacrifice of strength. Just check the handy coupon. Lock Joint Pipe Co., Box 269, East Orange, N. J.

How Engineers and Contractors Can Get This Comprehensive Water Control Apparatus Catalog

141. A 250-page catalog showng the full scope of Rodney Hunt water control apparatus is now available for distribution to consulting engineers, contractors and others actively engaged in water control construction work. Hundreds of diagrams, detailed descriptions and specifications show all types of sluice gates and related items, and a special section provides helpful engineering data. Send your request on business letterhead or use the coupon, stating your occupation. Rodney Hunt Machine Co., 7 Water St., Orange, Mass.

Avoid Needless Digging With This Valve Box Locator

165. Convenience and accuracy are keynotes of the Aqua Valve Box locator described in a full-color folder offered by Aqua Survey and Instrument Co., 2518 Leslie Ave., Cincinnati 12, Ohio. Cobalt alloy steel dipping needle is factory-set for any geographic location. Periscope type mirror arrangement permits effortless top reading. Get full details by checking the coupon.

Faster Pipe Laying With Precaulked and Threaded Joints

148. McWane 2" cast iron water pipe with threaded joints and precaulked bell and spigot pipe are described in folder WM-47. Additional data on 3" to 12" centrifugally cast pipe and fittings in folder WL-47, both issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala.

Helpful Data on Sluice Gates

158. In a well-organized 48-page catalog you will find complete engineering and design data on Pekrul sluice gates, headgates, automatic flap gates, lifts and accessories. Numerous models in 6" to 92" sizes are available, and all pertinent data will be found in this helpful booklet. Write Morse Bros. Machinery Co. Denver, Colo., or use the coupon.

Inserting Valves Without Shutdown

162. Do you have the latest data on equipment for inserting control valves where shutdown is impractical? Mueller catalogs H-20 and H-602 give all details on inserting valves and equipment, using hand-operated or power-operated machines. Get these catalogs today by checking the coupon. Mueller Co., Decatur, Ill.

What You Should Know About Meter Setting and Testing Equipment

166. Complete details on all equipment and proper methods for meter testing and installation are included in an excellent book published by Ford Meter Box Co., Wabash, Ind. All waterworks men concerned with setting and testing of water meters should have a copy of this book. Write for Catalog No. 50.

Handy Calculator for Cast Iron Pipe

175. With the handy Cast Iron Pipe Calculator you can determine at a glance the class, weight and dimensions of bell and spigot pipe. This slide-rule type calculator is absolutely free. Use coupon or write R. D. Wood Company, Public Ledger Bldg., Philadelphia 5, Pa.

A Short Course In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled, permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the coupon for free copy.

Helpful Data On Pipe Couplings and Repair Clamps

194. Comprehensive data on compression pipe couplings and band type pipe repair clamps in ¾" to 12" sizes and larger are offered by Morris Coupling and Clamp Co., Box 632, Ellwood City, Pa. Testing laboratory reports and installation pictures are included. For your copy check the coupon.

What You Should Know About The Centriline Process

197. The Centriline method for lining mains in place to stop leaks, prevent corrosion and increase carrying capacity is fully described in a handsome booklet issued by the Centriline Corp., 140 Cedar St., New York 6, N. Y. Many illustrations and typical case histories show the operation and economies of this process. The Tate process for lining smaller mains is also covered. Check coupon for your copy.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co, Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy. Get yours by checking the coupon.

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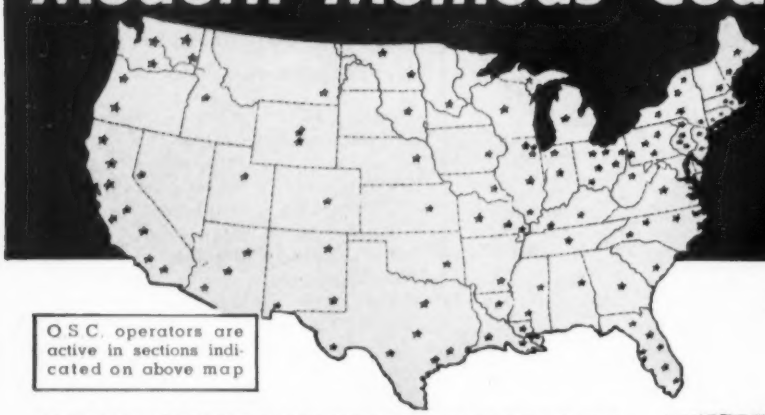

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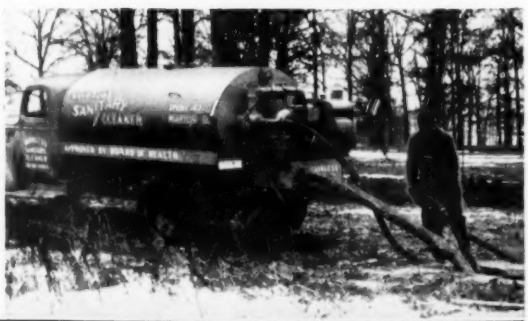

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Engineering Data On Mechanical Joint C.I. Pipe

183. General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala. Get this helpful data by checking coupon.

Locate Mains and Services Without Digging

186. A 16-page booklet tells how to use the Fisher "M-Scope" to locate buried pipes and valves by electronic means. Proper manipulation also determines depth of cover. Battery operated unit is readily carried by one man. Get data from Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif.

Installation Guide for Transite Pressure Pipe

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Pre-Cast Filter Bottoms For Water Treatment Plants

217. Construction information on the Wheeler Filter Bottom, pre-cast type, for water treatment plants is offered by Builders-Providence, Inc., 345 Harris Ave., Providence 1, R. I. Illustrated Bulletin Sup. 700-K2 gives the details you need for planning and construction. Check the coupon for a copy.

How to Compute Quantities of Jointing Materials

271. A helpful table for determining quantities of "Tegul-Mineralead" required, using jute or "Hyde-Ro Rings", plus complete answers to your questions on sulfur compound jointing materials will be found in Bulletin M-10 issued by Atlas Mineral Products Co., Mertztown, Pa. Check the handy coupon today.

Reference Book on Lubricated Plug Valves

273. Lubricated plug valves, including stick-proof lever sealed valves for easy operation and positive mechanical seal are fully described in reference books issued by Homestead Valve Mfg. Co., Box 550, Corapolis, Pa. Check the coupon for your copy.

Standard Specifications for C. I. Pipe and Fittings

278. Standard dimensions for cast iron water pipe and special castings are available in a convenient booklet offered with the compliments of U. S. Pipe and Foundry Co., Birmingham 2, Ala. Get your copy by checking the coupon.

Helpful Valve Catalog For Engineers

236. For complete descriptions of Darling double disc, parallel seat gate valves be sure to get Bulletin 5002 issued by Darling Valve & Mfg. Co., Williamsport, Pa. Construction details covering all valve parts and accessories are helpful for specification writers. Check the coupon for your copy.

All About Centrifugal Pumps

258. Where pumping performance counts you want to check your specifications carefully. Investigate the features of Fairbanks-Morse centrifugals. Use coupon or write to Fairbanks, Morse & Co., Dept. PW, Chicago 5, Ill.

Water Conditioning Data Book Offered To Engineers

259. All engineers and municipal officials concerned with water conditioning will want a copy of the greatly enlarged edition of the popular Permutit Data Book prepared by the Permutit Co., 330 West 42nd St., New York 36, N. Y. This completely revised book presents a compilation of 78 tables, all valuable to the engineer. Subjects include hydraulics, impurities in water, reactions and conversions of chemicals used in water treatment, alkalinity relationships and other helpful material.

What You Should Know About Turbine Pumps

294. In a colorful bulletin titled "Water Where You Want It . . . When You Want It" the Johnston Pump Co., 3272 Foothill Blvd., Pasadena 8, Calif., gives details on turbine pumps with both semi-open and closed impellers; oil or water lubrication; and adaptations for any power source or combination thereof. Get your copy of bulletin 1013 by checking the coupon.

Factors to Consider in Elevated Tank Selection

299. Details on the several different types of elevated steel tanks, including capacity ranges, tank dimensions and other factors to be considered in the selection of elevated tanks for modern water storage, plus discussions of

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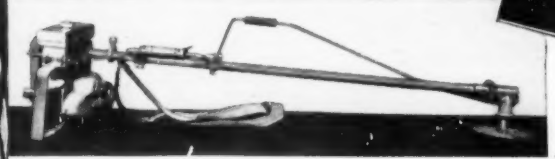

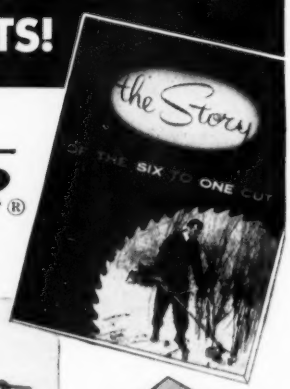

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Hundreds of American industries are showing big savings with the Brushmaster Saw. It cuts brush, from matted grass to saplings 4" in diameter or over, including vines, honeysuckle, thorns, etc. It's *safe* . . . operator can not come into contact with saw blade! It's *mobile* . . . goes anywhere a man can walk . . . operates freely from right to left, close to ground or overhead! Vibration-free, clutch-controlled, positive drive.

FREE!

This colorful booklet tells how machine magic has made all previous methods of brushcutting obsolete. Send for it today.

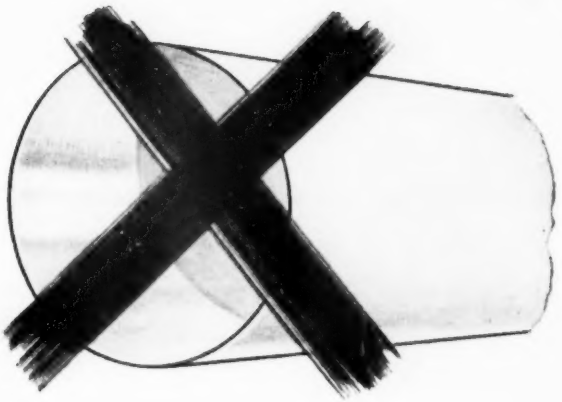
BRUSHMASTER SAW, INC.

89 EMERALD ST., KEENE, N. H.

Subsidiary of Harrington & Richardson, Inc., established 1871. — Manufactured and sold in Canada by H&R Arms Co., Ltd., Montreal, Canada

Yes-

you can specify smaller pipe



. . . when you protect it with BITUMASTIC® 70-B ENAMEL

PIPE LINES don't "shrink" when interior surfaces are lined with Bitumastic 70-B Enamel. Because this protective enamel prevents rust, corrosion, incrustation and tuberculation.

Thanks to this effective protection, you can select steel pipe for your water lines solely on the basis of desired capacity; you don't waste money by buying *over-sized* pipe in order to allow for future loss in flow capacity.

What's more, Bitumastic 70-B Enamel—when applied to a thickness of 1/32"—protects the exterior of pipe against the corrosive action of the soil in which it is buried. It is wasteful to specify an excess of wall thickness to compensate for corrosion. It is more economical to specify just enough wall thickness to give the pipe adequate structural strength and to use Bitumastic 70-B Enamel to overcome corrosion.

For your large-diameter water lines specify strong, durable steel pipe, lined and coated with Bitumastic 70-B Enamel. Your community will get worth-while savings. Write for full information

KOPPERS BITUMASTIC ENAMELS

REG. U.S. PAT. OFF.

KOPPERS COMPANY, INC., Tar Products Division, Dept. 1055-T, Pittsburgh 19, Pennsylvania

DISTRICT OFFICES: BOSTON, CHICAGO, LOS ANGELES, NEW YORK, PITTSBURGH, AND WOODWARD, ALA.

Get full details of this month's products . . . mail your Readers' Service card today.

To order these helpful booklets check the coupon on page 32.

new tanks for old towers and foundations are included in Bulletin 101 of the Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa. Check coupon for your copy.

Trencher Fits Municipal Needs

315. A bulletin describing the Cleveland Model 95 trencher has been published by the Cleveland Trencher Co., Cleveland 17, Ohio. The Model 95, called "The standard machine for city and suburban work", is versatile, manueverable and economical for use on water lines, service lines, road widening and all utilities trenching. Get this 8-page illustrated bulletin by checking the coupon.

Job Data Offered on New Steel Water Mains

342. A 16-page illustrated report listing construction details on steel water lines is entitled "Dresser Coupled Steel Water Lines in the Year 1952." Get your copy from Dresser Mfg. Div., 59 Fisher Ave., Bradford, Pa. by checking the coupon.

Corrosion Protection For Water Works

280. Steel pipe lines, elevated tanks, treatment plant equipment and all other steel structures subject to rust, tuberculation and attack by aggressive soils can be protected by long-lasting Bitumastic enamels. Send for bulletins today so that you can specify the right coating for your job. Use coupon or write Koppers Co., Tar Products Div., Pittsburgh 19, Pa.

●

STREETS AND HIGHWAYS

Easier Street Sweeping With Wilshire Municipal Sweepers

306. A handy chart included in a comprehensive 20-page bulletin enables you to check your street sweeping costs against the man-hour savings of all Wilshire power sweeper models. Other helpful information shows all details on sweepers for large and small communities. Get this illustrated bulletin by writing Wilshire Power Sweeper Co., Glendale 4, Calif., or check the coupon.

Latest Data on Rubber Roads

296. A report covering all developments to date on the use of natural rubber in road surfacing of asphalt highways has been issued by the Natural Rubber Bureau, 1631 K St., N. W., Washington 6, D. C. Get your copy of this 52-page booklet which includes new data on research and full reports on test roads in many states. Use the handy coupon.

Use Hot Patch Material On All Maintenance Jobs

297. With the Barber-Greene Mixall you can get hot patch material wherever and whenever you need it for all maintenance jobs. Send for new 8-page bulletin that gives full information on this small, highly portable unit that turns out all types of bituminous patch material in any quantity you need. Write Barber-Greene Co., Aurora, Ill., or use the coupon.

Hot or Cold Patching Mixtures Prepared on the Job

304. By preparing your patching mixtures, hot or cold, right on the job, you can use them immediately with a minimum of handling. Get full data on the McConnaughay Model HTD "Multi-Pug" Asphalt Mixer for fast, easy and economical preparation of patch materials. Write K. E. McConnaughay, Lafayette, Ind. or use the coupon.

How the Mobil-Sweeper Can Improve Street Sweeping

305. Sweeping costs can be cut with the Mobil-Sweeper which features safe highway speeds up to 55 mph, carries 2 2/3 cu. yd. dirt hopper, sweeps swath up to 10' wide with full floating brooms. Hills and deep gutters are no obstacle. Write to The Conveyor Co., 3260 E. Slauson Ave., Los Angeles 58, Calif. or use coupon for complete details on this machine.

Do You Have Complete Black Top Equipment Data?

41. In 36-page catalog AA a full line of maintenance is covered. Units described and illustrated include several models of pressure distributors, supply tanks, sprayers, brooms, asphalt kettles, portable rollers, and accessory Cincinnati 2, Ohio.

Levels Sidewalks and Curbs Quickly and Easily

29. How the Mud-Jack Method for raising concrete curb, gutter, walks and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a bulletin by Koehring Company, 3026 W. Concordia Ave., Milwaukee 16, Wis. Check the coupon.

Get Data Now On This Catch Basin Cleaner

34. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit. Netco Div., Clark-Wilcox Co., 118 Western Ave., Boston 34, Mass.

How to Save Time on Curb and Gutter Work

143. Every type of curb and gutter work is illustrated in the 12-page Heltzel catalog on steel forms for building concrete curbs, gutters and sidewalks. Time-saving setups show how to speed up the job and save money. Get your copy from Heltzel Steel Form & Iron Co., Dept. PW, Warren, Ohio.

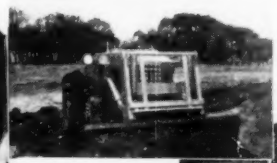
Black-Top Paver Offers Many Advantages

150. The flexible Adnun Black Top Paver lays any asphalt mix, hot or cold, in widths from 6 ft. to 13 ft. Careful design lowers operating cost and cuts maintenance. Attachments spread stone, cinders or slag. Get full data on this machine by checking coupon. The Foote Co., 1954 State St., Nunda, N. Y.

THE LOW COST Lessmann HEAVY DUTY LOADER

DOES THESE JOBS AT LOWER COST

With dozer blade, the Lessmann grades, maintains roads . . . back fills on construction and sanitation projects.



Hydraulic Power Crowd exerts 7½ ton forward thrust while standing still! Digs compacted soils 12" below wheel level.

Snow or trash bucket has clearance for street clean-up work. Note visibility, simple controls, protection afforded operator.

Crane hook attachment handles drums, forms, cast-concrete culvert sections, etc. Attachments are easily changed, secured with 4 steel pins.

A Lessmann digs even frozen aggregate, sand, coal . . . takes a ton bite with a 7½ ton forward thrust *while unit is standing still!* High clearance permits Lessmann to load largest trucks as shown in illustration above. Engine, transmission, driving axle, hydraulic system and brakes are STANDARDIZED PARTS . . . Ford, Timken, Vickers, Bendix.

All weather cab, Vickers Power steering and Bendix Hydro-Vac Brakes are available as optional equipment on all three models. Write for free folder giving complete information.

HYDRAULIC POWER-CROWD

Lessmann Manufacturing Co. 2011 EASTON BLVD. DES MOINES 4, IOWA

HOW FORWARD-LOOKING COMPANIES

Make Costly Machines Earn More Dollars-Per-Hour!

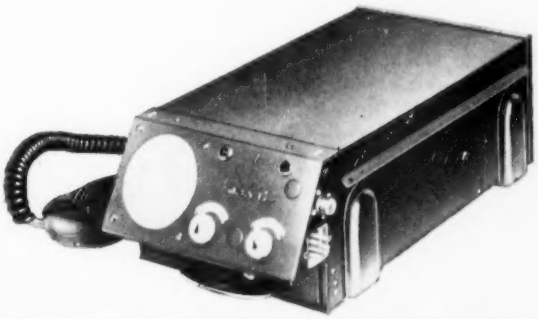
MOTOROLA 2-WAY RADIO

cuts "down time" and "deadheading" —makes each day's operations more profitable with maximum use of equipment

Progressive companies are using Motorola 2-way radio to get greater day-by-day returns from their investment in equipment. Instant Motorola communications co-ordinates operations, reduces lost time, helps meet construction deadlines . . . reduces "deadheading." Costly breakdowns are reported in seconds. Improved efficiency of every piece of equipment pays for Motorola installations over and over again.

Eight exclusive Motorola features guarantee precision selectivity, time-tested durability, obsolescence-free design. Permakay, Motorola's permanent selectivity wave filter, eliminates 15 nuisance tuning adjustments forever. Get all the facts about this rugged, reliable communications tool. *Write to Dept. 2286-PW today!*

Construction foreman, operating base station console, maintains instant supervision, keeps progress report up to date, co-ordinates activities between crews.



Uni-Channel Sensicon Dispatcher serves as a fixed or mobile station. It's ruggedly built to take jolts and shocks of rough roads . . . obsolescence-proof circuits stay up to date for years to come.

2-way Radio

Motorola

Communications & Electronics, Inc.

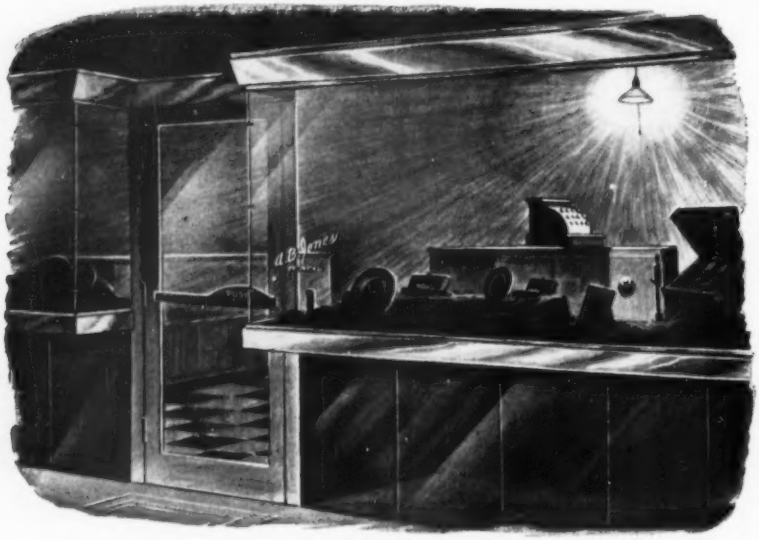
A SUBSIDIARY OF MOTOROLA, INC.

900 N. Kilbourn Ave., Chicago 51, Illinois • Rogers Majestic Electronics Ltd., Toronto, Canada

Thousands use our Readers' Service card to keep up to date . . . do you?

To order these helpful booklets check the coupon on page 32.

The light that fails—

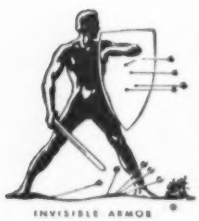


Yes, light fails to provide the protection the owner of this store needs.

Every three minutes a burglary or robbery occurs somewhere in the United States. In spite of all the lights left burning throughout the night in many business establishments, burglars and robbers succeed in stealing valuable merchandise, money and other property.

Because burglars and robbers steal in spite of all safeguards, let National Surety's experienced specialists in Commercial Burglary and Robbery Insurance study your problems and recommend policies drawn to meet your special requirements both as to the risks to be covered and the values to be insured.

Call National Surety's Agent today...



YOUR INVISIBLE ARMOR IS A NATIONAL SURETY BOND OR POLICY

NATIONAL SURETY

National Surety Corporation, 4 Albany St., New York

National Surety Corporation, Dept. P
4 Albany Street, New York 6, New York

Please send me further particulars about your Commercial Burglary and Robbery insurance. I understand there is no obligation on my part.

Firm name_____

By_____ Position_____

Street address_____

City_____ Zone____ State_____

Now's the time to mail this month's Reader's Service card.

End Manhole Rattle The Easy Way

184. It's easy to safeguard manholes and end annoying rattles by using Tapax, a wear-resisting, resilient manhole cushion available in convenient 100-ft. reels from Joseph G. Pollard Co., Inc., New Hyde Park, N. Y. Full details in Bulletin 14. Check the coupon.

Get Full Data On Aggregate Spreaders

231. Accurate control for spreading crushed rock, chips, sand or ice control materials is featured by all models of Highway Equipment Co. materials spreaders. Data on both trailer and tailboard types available by checking the coupon. Highway Equipment Co., 630 D. Ave., Cedar Rapids, Iowa.

Give Full Protection To Treated Poles and Timbers

267. Bolt holes in treated poles and timbers used for guard rails and structures can easily be the first point of decay. Now you can assure maximum life by using the Greenlee Bolt Hole Treater, a simple device that forces preservative into the wood cells. Bulletin 13-15 gives the details. Greenlee Bros. & Co., Rockford, Ill.

Design Data on Universal Concrete Cribbing

274. Complete information on concrete cribbing for embankment retaining walls, bridge abutments, highway underpasses and other structures will be found in a new bulletin issued by the Universal Concrete Pipe Co., 297 S. High St., Columbus, Ohio. Check coupon for free copy.

Heating, Thawing and Melting With Hauck Burner Equipment

277. A helpful 16-page bulletin covers the complete line of Hauck heating and melting equipment. Data covers units for every water, sewer and street department purpose, from "one-man" burners to large size portable kettles. For a useful addition to your reference file, get Bulletin 1068 from Hauck Mfg. Co., 117-127 Tenth St., Brooklyn 15, N. Y.

"Quick-Set" Posts for Signs and Snow Fence

333. For quick, easy driving in any type of soil, be sure to check Buffalo Steel "Quick-Set" sign posts, available in any length you need and ready-punched for fast installation of signs and snow fence. Get full data from Buffalo Steel Div., H. K. Porter Co., Inc., Tonawanda, N. Y. Just check the handy coupon.

●

BUSINESS AND ADMINISTRATION

What Bonded Performance Can Do For You

121. On every construction job your city or county should be protected from a contractor's default or inability to perform the work. Learn what "Bonded Performance" can do for you. Write National Surety Corp., 4 Albany St., New York, N. Y., or check the coupon for full details.

Booklet Outlines Scheduled Preventive Maintenance

223. An interesting case history on reduction of equipment failures and less "down-time" through scheduled preventive maintenance is offered by Remington Rand Inc., Management Control Library, 315 Fourth Ave., New York 10, N. Y. Ask for Folder KD656 or check the handy coupon for your copy.

Aerial Surveys and Maps from Photographs

229. Written in non-technical language, a 16-page booklet with this title gives a complete explanation of aerial surveys for the municipal field. Interesting step-by-step pictures show how planimetric and topographic maps, mosaics and atlas sheets are produced by Abrams Aerial Survey Corp., Lansing 1, Mich. Check the coupon for your copy.

DELIVERS WATER CHEAPER

Philadelphia Dresser-Couples 2-mile steel main in expanding program of general waterworks improvement.

In adding to many miles of Dresser-Coupled steel mains laid since the War, Philadelphia engineers again recognized the outstanding advantages of this type of construction. These twin steel lines meet the needs of central and southern Philadelphia.

Dresser-Coupled steel mains are a sound investment. The beam strength of steel pipe, plus the non-rigidity of both pipe and couplings, assures a husky, flexible, permanently tight line. Glass-smooth linings sustain high carrying capacity. Dresser-Coupled installations fit in well with existing structures . . . are readily adaptable for future changes.

Actual installation is fast and relatively simple. Lighter weight steel pipe is easier to handle. Long pipe lengths mean fewer joints. Small crews, with a minimum of skill, supervision and heavy equipment, make joints faster, surer. The result—lower cost, maintenance-free lines.

BE SURE **you get the *best* line at the *best* price. Always put steel pipe and Dresser Couplings in *your* specifications.**

DRESSER® COUPLINGS

Dresser Manufacturing Division, 69 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston, Texas; 101 S. Bayshore Highway, South San Francisco, California. Sales Offices: New York, Philadelphia, Chicago, Houston, South San Francisco. In Canada: Toronto, Ont.

Need more facts about advertised products? Mail your Readers' Service card now.

To order these helpful booklets check the coupon on page 32.

Dig 'em and fill 'em with CLEVELANDS

The Cleveland "Baby Digger" Model 95 is making short work of cutting trench for a gas main extension under good digging conditions in Minneapolis. Even greater savings were effected by the 95 during severe winter digging conditions.

Here, a Cleveland Model 80 is speedily and cleanly backfilling the trench shown in the top picture. The 80 is also an excellent pipe layer. When job conditions require backfill compaction, the 80 does an outstanding job with no additional men or equipment necessary.

The
CLEVELAND TRENCHER CO.
Pioneer of the Modern Trencher
20100 ST. CLAIR AVENUE • CLEVELAND 17, OHIO

Get full details of this month's products . . . mail your Readers' Service card today.

Your Property is Worth Good Protection

176. When installing link fence you want protection against rust and corrosion as well as vandalism. Investigate chain link fence made of "Konik" metal described in "Planned Protection" published by Continental Steel Corp., Kokomo, Ind.

Two-Way Radio Equipment For All Departments

293. The benefits of two-way radio communication in the uncongested non-interference 450-megacycle range make full information on this subject important to all engineers. Get full data on trouble-free systems from Motorola, Inc., Dept. PW, 4545 Augusta Blvd., Chicago 51, Ill. Just check the coupon.

CONSTRUCTION EQUIPMENT AND MATERIALS

1,001 Profitable Uses For Holmes-Owen Loader

39. The addition of a Holmes-Owen Loader to your dump truck converts it into a complete digging and loading unit that enables one man to load, haul and dump. Illustrated folder shows how this self-loading unit with hydraulic crowding action can be a real time and labor saver for the municipality or contractor. Check the handy coupon for full data. Ernest Holmes Co., Chattanooga, Tenn.

Concrete Saw Cuts Smooth, Straight Edges

65. When the sides of patches and trenches are sawed before breaking, a saving of 25% in removal costs is claimed. And the smooth, straight edges won't spall or crack after replacement material is poured. Investigate the exclusive features that give maximum economy to Clipper concrete saws. Full information from Clipper Mfg. Co., 2823 S. Warwick, Kansas City 8, Mo., or check the handy coupon.

Examining a Tractor Piece by Piece

99. The 32-page catalog published by International Harvester Company should be studied by every tractor owner, for in it each unit from engine to track of the TD-9 Diesel is considered separately. These piece by piece discussions are supplemented by notes on easy servicing, versatile applications and attachments for every need. Get your copy of form CR-313-A from International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., or check the handy coupon.

Booklet Helps Design of Custom-Engineered Steel Buildings

110. Custom-engineered Butler steel buildings are available in every size, type and design to meet your building needs. In a helpful 32-page booklet you will find details on several basic designs and an unlimited variety of door, window and interior treatments; answers to your questions on construction and erection; and many illustrations of typical uses. Use the coupon or write to Butler Mfg. Co., Kansas City, Mo.

How Air Placement of Concrete Will Help on Your Jobs

215. There are hundreds of jobs that can be done easier and cheaper by air placement of concrete: reservoir, tank and pool linings, concrete maintenance of all sorts are just a few of the applications. Get full details on two models of the high speed, easily operated "Bond actor" from Air Placement Equipment Co. 1009 West 24th St., Kansas City 8, Mo. Check the coupon.

Handbook of Castings For All Public Works Construction

220. Every type of construction casting needed by engineers and contractors in the public works field will be found in a 136-page catalog issued by Neenah Foundry Co., Neenah, Wis. Detailed illustrations and complete tables of dimensions will help the designer and materials buyer. Get your copy of this valuable catalog by checking the coupon today.

Mobile Prefers Concrete Pressure Pipe

Part of the new water supply project completed last year in Mobile, Alabama, included the installation of sixteen miles of concrete pressure pipe. Nine miles of 60-inch and seven miles of 48-inch pipe were laid to carry the 45,000,000 gallons of water Mobile uses in an average day.

Mobile engineers selected concrete pressure pipe because it is economical to install and maintain . . . it will carry water for generations without reduction in carrying capacity due to tuberculation or corrosion . . . and it is immune to rupture or blow-out.

Concrete pressure pipe offers these same advantages for the water systems of any size community. It is available in a wide range of diameters and can be installed to fit individual requirements. Let us show you how concrete pressure pipe can bring your community "water for generations to come."

Water for Generations to come

Concrete PRESSURE Pipe

AMERICAN CONCRETE PRESSURE PIPE ASSOCIATION
228 North LaSalle Street
Chicago 1, Illinois

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

To order these helpful booklets check the coupon on page 32.

Durable Gratings and Treads Are a Good Investment

147. Gratings for walks around settling tanks and other parts of treatment plants, both out-doors and in, for stairways, floors, and balconies, are described in an illustrated 16-page bulletin by Irving Subway Grating Co., 50-53 27th St., Long Island City 1, N. Y.

How to Get Better Concrete Construction

198. A comprehensive report on the use of "Pozzolith" as a means of increasing the strength and durability and reducing the permeability of concrete structures, while reducing costs at the same time, is presented in 32-page Bulletin LH 9-52 of Master Builders Co., Cleveland 3, Ohio. Every engineer and contractor should study this helpful data. Check coupon for your copy.

How to Choose the Right Self-Priming Centrifugal Pump

212. Descriptive folders on the complete line of contractors' pumps have been issued by the Gorman-Rupp Co., Mansfield, Ohio. 2-in. to 10-in. models are illustrated, performance tables are shown and pump selection tables are included to assist in choosing the proper pump for different jobs. Check coupon for your copies.

Operator's Handbook For Cable and Hydraulic Shovels

284. In a cartoon-style handbook, Caterpillar Tractor Co. explains the techniques of all types of excavation jobs with Caterpillar cable and hydraulic shovels. Four-color illustrations show these tractor-mounted machines on pavement construction and repair, culvert installation, gravel digging and many other operations. Check the coupon for your copy.

Drill Concrete With Your Ordinary Electric Drill

295. Substantial cost-per-hole savings are claimed for Tilden Rotary Drills which penetrate 2" to 4" per minute. Available in sizes ¼" to 4". Cutters can be resharpened. Full data from Tilden Tool Co., 209 Los Molinos, San Clemente, Calif. Just check the coupon.

The Loader That Digs Like a Power Shovel

317. The power crowder-arm of the Lessmann loader gives you power shovel advantages in this tractor-mounted unit, and enables you to fill the bucket in tough digging without spinning the wheels. Check the coupon for all the details on this rugged, heavy-duty unit. Lessmann Mfg. Co., Des Moines 4, Iowa.

Easy-Reading Bulletins Explain Surveying Instruments

329. A series of instructional bulletins which explain the inner workings of surveying instruments have been issued by David White Co., 315 W. Court St., Milwaukee 12, Wis. Written in question and answer form, they make interesting reading for the beginner and experienced surveyor alike. Get your copies by checking the coupon.

Keep Batteries in Peak Condition

337. No more battery troubles on slow-moving trucks and other equipment that fail to keep up the charge with conventional DC generators. The Leece-Neville AC-DC generating system is easy to install, needs minimum maintenance and supplies all the power you need. Get full details by checking the coupon. Leece-Neville Co., 5109 Hamilton St., Cleveland, Ohio.

●

SNOW AND ICE CONTROL

Uniform Salt Spreading Saves Material

145. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt waste, saves time and labor. Get Folder BL for full details on this spreader and table of material application rates. Use coupon or write Tarrant Mfg. Co., Dept. PW, Saratoga Springs, N. Y.

End Dangerous Ice Hazards

256. Many progressive municipalities use rock salt as standard practice for prevention of ice hazards on streets and highways. Get full data on Sterling "Auger-Action" Rock Salt and suggestions on storage methods from International Salt Co., Scranton, Pa. Check the coupon today.

Ice Control Without Corrosion Dangers

282. Virtually all corrosion is prevented when rust inhibitor "Banox" is used in conjunction with salt for snow and ice control. Properties of this material and performance results are described in bulletins issued by Calgon, Inc., Hagan Bldg., Pittsburgh 30, Pa. Check coupon for your copies.

How Motor Graders Beat the Snow Problem

307. The power and directional control of Austin-Western Four-Wheel Drive, Four-Wheel Steer Power Graders are a combination that beats the toughest plowing combination. Get data on plow and snow loader attachments for graders from Austin-Western Co., Aurora, Ill. Check the coupon.

20-Page Book Shows All Snow Plow Features

313. The full line of Ross snow plows, including one-way "Rigid" types, trip moldboard plows, Vee plows, snow wings, sidewalk plows and plow hitches, hydraulic controls, plus spreaders for ice control are featured in a profusely illustrated booklet issued by the Burch Corp., Crestline, Ohio. Be sure to get this comprehensive booklet and review your plow requirements. Check the coupon.

Snow Plows for Every Street and Highway Need

335. For details on the full line of Frink Sno-Plows, including the new taper-type reversible plow with hydraulic roll-over control, reversible trip-blade plows, Vee plows and all accessories, check the coupon today. Frink Sno-Plows, Inc., Clayton, N. Y.

NO MORE RAKING LEAVES

Here's the key to neat, leaf-free grounds — remove fallen leaves quickly, easily, and *economically* with the TURBO-JET Power Leaf Mill*! Based on an entirely new principle, the TURBO-JET employs a high velocity stream of air to suck up leaves, grate them into a fine powdery chaff, and blow the chaff back into the lawn to act as a mulch. Easy to operate, light and simple in construction, the TURBO-JET efficiently cleans leaves from lawns, out of ivy beds and shrubbery, from around fences and copings and other "hard-to-reach" places. Sturdy TURBO-JET moves a *lot* of leaves in a short time — permits one man to do the work of ten men with rakes!

Write today for folder and name of nearest dealer.

THE TURBO JET MFG. CO.
30 BOWMAN TERRACE
CINCINNATI 29, OHIO

TURBO JET
PATENT PENDING
THE TURBO JET MFG. CO.
CINCINNATI, OHIO

it's the Guest who Counts
at
HOTEL Metropole
SIXTH AND WALNUT

AMERICAN HOTEL ASSOCIATION AHA

It's our ambition to keep you happy as a king from check-in to check-out time! Besides perfect service . . . cheerful rooms, nationally known food . . . health clubs for men and women . . . private banquet rooms.

Convenient parking facilities.
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400 FINE ROOMS FROM $2.50

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GENERAL MANAGER

OFFICIAL AAA HOTEL

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PAYLOADER®

powerful 3 way snowfighters

PUSH

PLOW

LOAD

"PAYLOADERS" are all year 'round producers. When Winter comes in the snow belt, these powerful tractor-shovels keep right on being useful — loading and plowing snow from streets, alleys, highways and parking areas. Their big pneumatic tires provide effective traction without damaging pavement and curbs . . . full-reversing transmissions insure quick reverse and high maneuvering speed . . . operator's position allows fullest visibility for fast, safe operation.

Big four-wheel-drive "PAYLOADER" models are especially popular for "V" plow work. The powerful, double-acting hydraulic control exerts up to 3 tons of lifting capacity to "break out" of heavy drifts, and gives tremendous down-pressure to dig in quickly.

For Summer and snow, for their all-season GO "PAYLOADERS" make sense to both tax-payers and public officials. These unit-design tractor-shovels are available in sizes and types to meet your needs. See your "PAYLOADER" Distributor today. The Frank G. Hough Co., 761 Sunnyside Ave., Libertyville, Illinois.

SAY "HUFF"

PAYLOADER®

THE FRANK G. HOUGH CO. · Since 1920

Now's the time to mail this month's Reader's Service card.

Want cheers instead of sneers from motorists?

use BANOX*

and banish salt-slush corrosion

Motorists cheer when Banox is added to de-icing salt for two very good reasons . . .

1. They enjoy clean, safe, winter pavements made possible by salt de-icing without the penalty of salt-slush corrosion.

2. As taxpayers they approve the double economy of snow and ice removed with salt, plus the savings which result when Banox protects municipal equipment, bridges and other costly metal surfaces from corrosive attack.

Banox is easy to use. As little as 1% added to the salt by road maintenance crews halts corrosion. It does not have to be carefully or specially mixed; the melting action and spreading by traffic insures even distribution.

Use BANOX and salt instead of cinders or sand and save money. You get cheaper, faster, more effective snow and ice control, and since the mix does *not* clog gutters, sewers and catch basins, there is no costly clean-up in the spring.

Remember—one pound of BANOX to every 100 pounds of salt is all that's needed. End winter weather corrosion worries, send for your free copy of "Stop, Look and Save with BANOX."

BANOX

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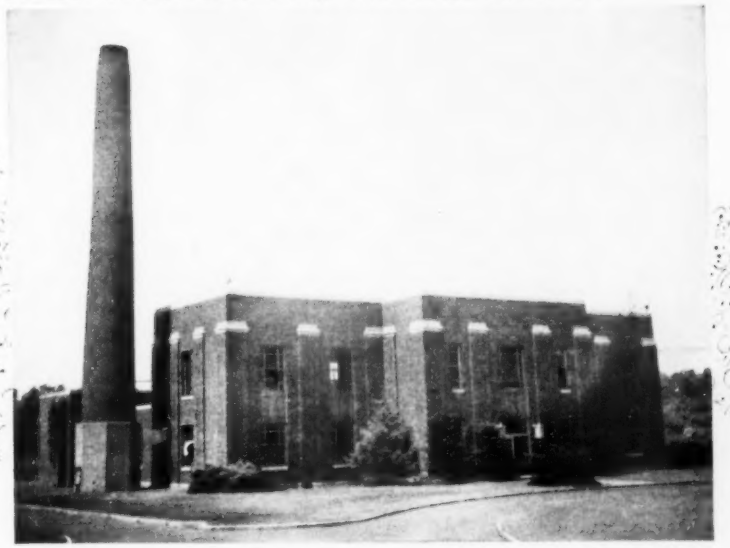

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Twelve years ago, the Sewage Treatment Plant at Springfield, Mass., was placed in operation. The sludge disposal equipment was a C-E Raymond Flash Dryer Unit capable of handling over 3 tons of dry solids per 8-hour day.

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In a typical year, the C-E Raymond Unit at Springfield flash dries and incinerates approximately 780 tons of dry solids. Incoming sewage contains approximately 213 parts per million of suspended solids. Removal, including grit, is about 61%.

The compact, flexible unit at Springfield, with its twelve years of successful service, highlights how effectively sewage sludge can be disposed of. This is true whether your community is small or large. To see how your locality, too, can be served with C-E Raymond Equipment, get in touch with the office nearest you. Addresses are listed below. B-685

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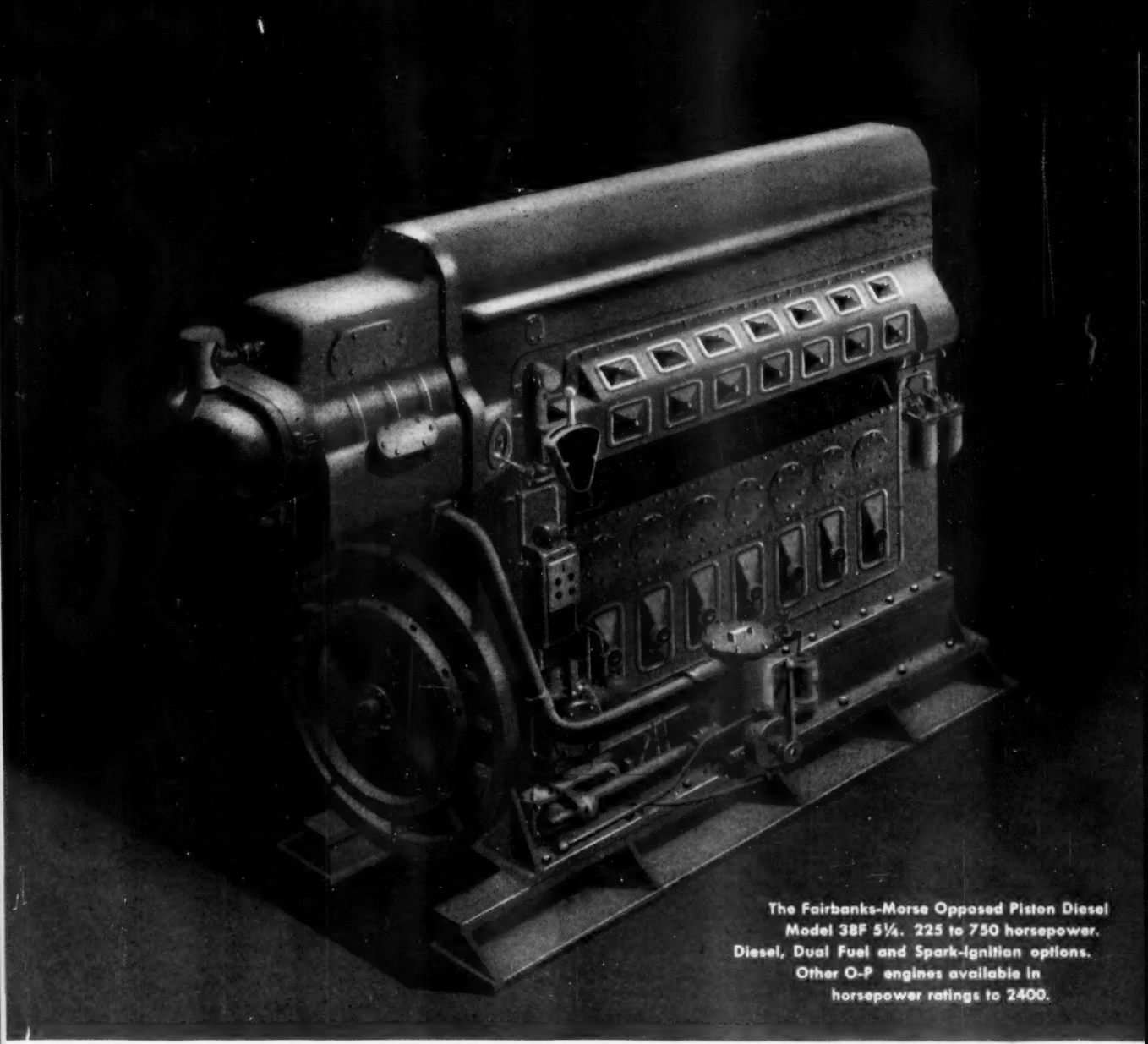

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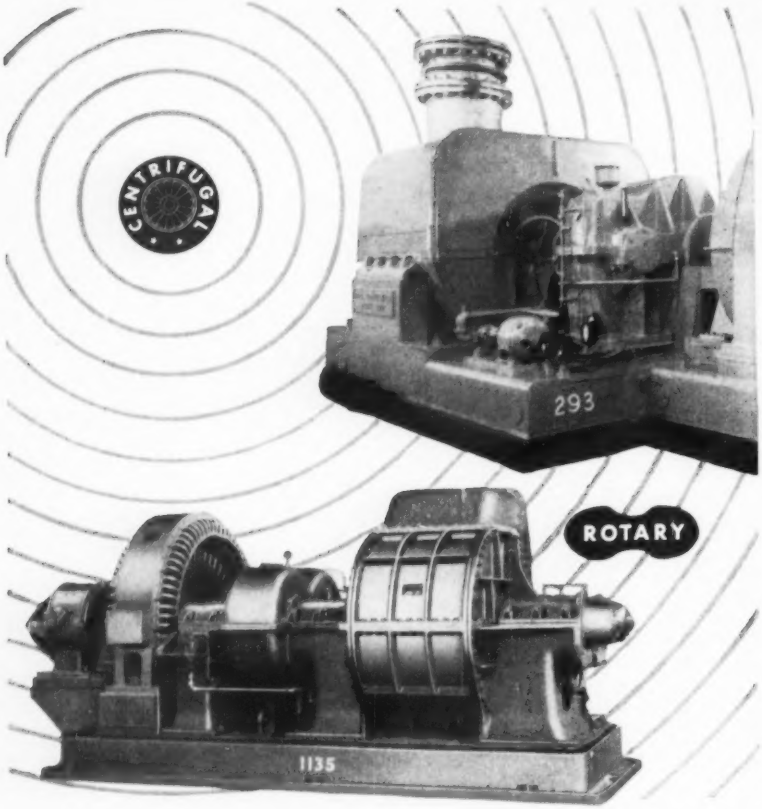

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LETTERS TO THE EDITOR

FLOOD CONTROL

I enjoyed your editorial entitled "Good Sense and Good Engineering for Flood Control" in which you congratulate Veatch, Howson and Wolman on their proposal for controlling floods in the Kansas River Basin.

The preliminary report on this matter was presented to a meeting of both Houses of the Legislature last February. Abel Wolman made the actual presentation in a one-hour summary which an opponent to his plan described as "the most statesmanlike address ever heard in these legislative halls."

The high point of the evening, however, was a cross-examination which was attempted by a senator from Kansas City who has a reputation as an excellent trial lawyer. Dr. Wolman's rapier-like verbal thrusts plus his obvious command of the facts won over the legislators and the galleries until they forced the Kansas City senator to sit down with a five-minute round of applause to one of Dr. Wolman's replies.

Dwight F. Metzler
Chief Engineer & Director
Division of Sanitation
State Board of Health
Lawrence, Kans.

CONDITIONING PROBLEMS

There has been considerable increase in the use of cooling systems. It has progressed to such an extent that it is becoming a strain both on our water supply and sewage disposal facilities. We have permitted the disposal of cooling water into our storm water system but unfortunately many properties do not have access to the existing facilities. We have not permitted the discharge of cooling water into our sanitary system since it is not designed for

HOLLOWS COST MONEY!

If you hold to within 5% of grade (that's less than ½ inch on a 9 inch thickness of material) you are putting almost 176 cu. yds. of extra material in every mile of road. You estimate what those 176 yds. cost you in your area . . . Hollows cost money!

The Adnun equipped with the Fluid Level will materially reduce waste in spreading stone and other base course materials and in laying asphalt base and surface.

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With the Adnun Fluid Level you have full control from subgrade to finished surface. With each course laid by the Adnun to an absolute plane and to accurate thickness *all the way* across the road and for every mile, better density and longer road life with less waste of materials is a sure result. With the Fluid Level you should beat that 5%.

Don't throw away material! Figure closer with the Adnun and the Fluid Level. If you haven't seen the booklet, "Put a Level on your Roads," ask for it.

* The Fluid Tells you it's Level. A turn of the hand adjustment wheel holds a positive grade. Every mile of road can be uniform as to thickness and density.

If you haven't seen the little booklet, "Put A Level On Your Roads," ask for it. It has some new thinking on road building.

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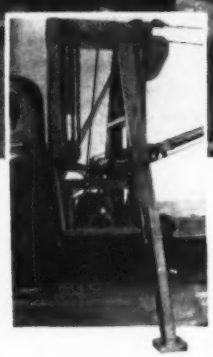

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this great increase in water. Practically all our sewage must be pumped and it is expected that within a year or two we will have a considerable increase in cost due to treatment of sewage.

I am writing to inquire as to whether you have any information available on this subject including any suggested ordinances that might be adopted by a community confronted with this problem. We are considering the possibility of admitting into our sanitary system a limited amount of overflow or condensed water if a recirculating system is used, possibly limiting the quantity to some amount which you may suggest.

I assure you that any help that you can give in connection with this problem will be greatly appreciated.

W. E. Rosengarten,
Township Engineer,
Ardmore, Pa.

SOIL ENGINEERING

The article is interesting and written in a style that should be readily understood by highway engineers and others.

Carlton N. Conner
Bureau of Public Roads,
Washington, D. C.

We are in hopes that he will give us something better than the usual fare when he writes on the subject of field practice. In the work-a-day practice of soil engineering, much important information is missed, and much time is wasted because of bad field techniques and use.

O. L. Stokstad
Michigan State Highway Dept.,
Lansing, Mich.

. . . in the second and final installments Prof. Ritter should emphasize the complexity of soil deposits and their various and varying engineering properties, as well as the difficulty of obtaining accurate solutions to many soils problems.

G. Albert Hill
State Highway Commissioner
Hartford, Conn.

You are on the right track in publishing this kind of basic material for engineers. The only suggestion I might make is that, whereas this series is directed at city, county and state engineers, you might consider a companion article or editorial, directed at the engineer's bosses, calling attention to the value to them

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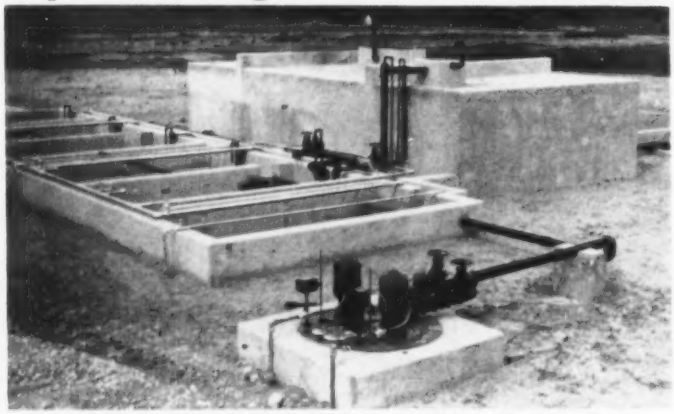

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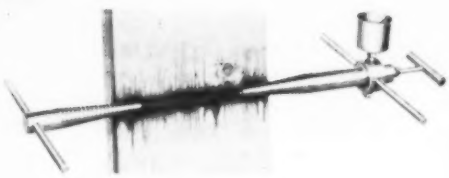

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and the taxpayers of adequate training, research and laboratory work on the part of their engineers.

Edwin B. Eckel,
Chief, Engineering Geology Branch
U. S. Dept of Interior
Denver, Colorado

In a discussion of the fundamentals of any subject, there is, of course, always the danger of oversimplification which too often tends to convince the reader that he has mastered the entire field and has thus become an expert on the particular subject. It is no easy matter to maintain a proper balance between a popular and theoretical approach, but it is our feeling that Prof. Ritter has succeeded quite well in his first instalment.

G. T. McCoy,
State Highway Engineer
Sacramento, Calif.

. . . you are to be commended for publishing this excellent piece of work.

L. F. Schaeublin
Asst. Director & Chief Engr.
State Dept. of Highways
Columbus, Ohio

I believe the articles will be of great help in calling to the attention of engineers the need for applying the principles of soil engineering to their everyday work. The one danger, as I see it, is that Prof. Ritter makes the subject appear so easy, that some engineers may be tempted to apply the principles to their problems without sufficient background of experience. It might be well, somewhere in the series, to emphasize the need of competent advice in solving any but the simplest of problems.

T. J. Montgomery,
City Engineer
Cincinnati, Ohio

. . . you are right in including some articles of this character in your publication.

E. L. Schmidt
Secretary of Highways
Pennsylvania Dept. of Highways
Harrisburg, Pa.

This article, I think, is very good. It may be a little too technical for the broadest help, but I think it is a good step in the right direction.

J. C. Akers
Engineer
Davidson County Highway Dept.,
Nashville 3, Tenn.

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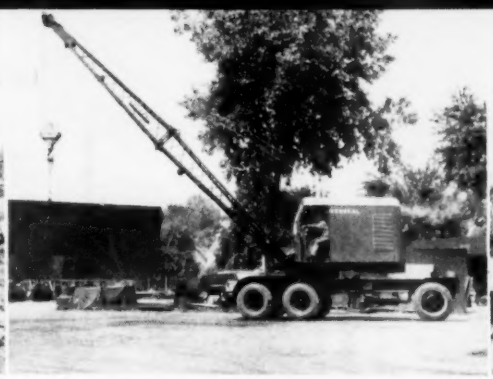

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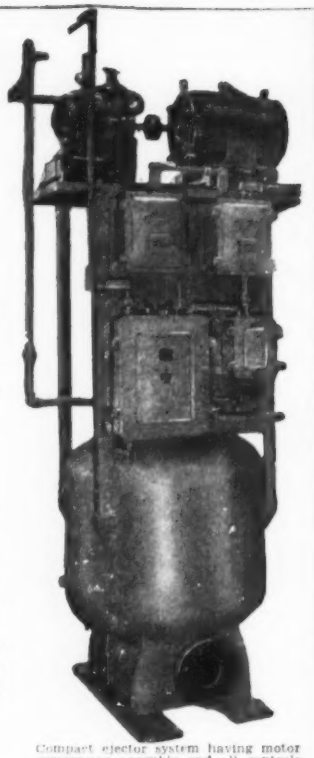

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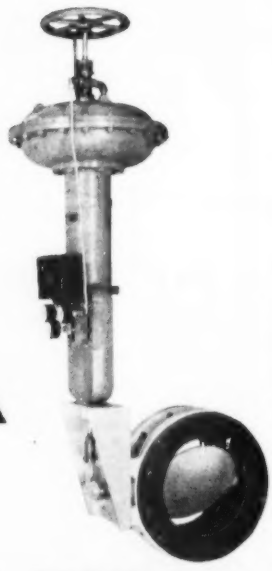

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The article is well written and timely and very much worthwhile. My only suggestion is that Prof. Ritter, if he has not already done so, include a selected bibliography with the third instalment of the article in order that interested readers may continue their reading in this field.

M. G. Spangler
Research Professor of
Civil Engineering,
Iowa State College
Ames, Iowa

. . . most definitely fills the need for the practical engineer in dealing with soil engineering in understandable language. One of the many features that deserve merit for their presentation is that dealing with weights and value relationships. The necessary theory is given without recourse to complicated soil mechanics theory of no practical need for the average working engineer. It is our opinion, from a study of the first instalment, that an adequate short course could be given to concerned personnel in this field of work without modification or departure from the text as presented.

J. Eldridge Wood
Materials Engineer
State Roads Commission
Baltimore, Md.

There is need for this sort of article as it gives to the busy engineer, not having a background in soil engineering, an opportunity to familiarize himself with some of the basic concepts of the subject.

O. L. Kipp
Chief Engineer
Dept. of Highways
St. Paul, Minn.

. . . I would declare a moratorium of ten years, at least, on all articles dealing with soil, hoping meanwhile, one small grain of brand new information concerning Mother Nature's modus operandi might appear during that time out of the babble of voices and confusion of thought.

L. A. Palmer
Bureau of Yards & Docks
Dept. of the Navy
Washington 25, D. C.

Comparing the subject article with both written ideas, established results and the simple and easy understandable style of presentation, I believe it an excellent and much needed discussion of the subject.

J. L. Land, Chief Engineer
Bureau of Materials & Tests
State Highway Dept.
Montgomery, Ala.

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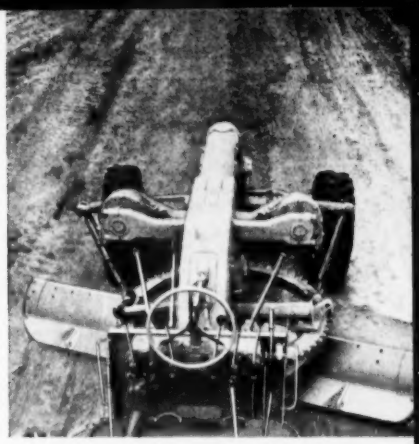
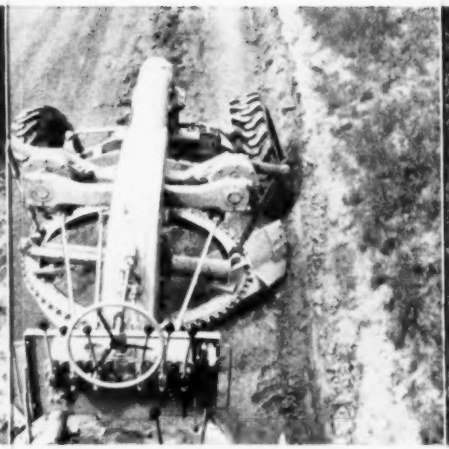
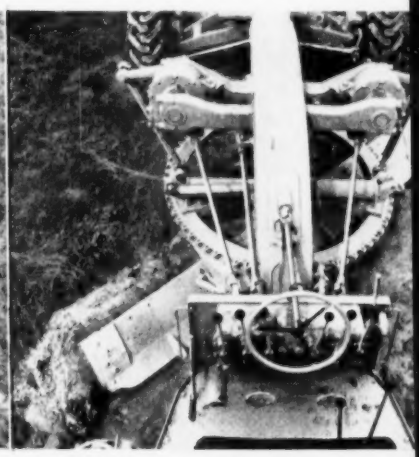


GRADING — Look at that single member frame — it really lets you see what you're doing . . . means efficient grading on *any* job.

SLOPING — Look how much better you see . . . how much steadier your blade is with small control rods leading out to lift cases located directly over the circle.



DITCHING — Look at the low control panel. It gives you a clear view of the blade . . . helps insure a clean, smooth ditch.



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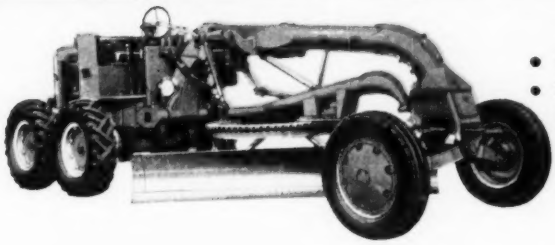

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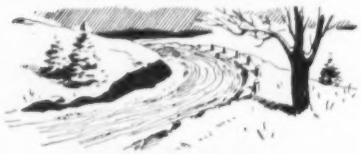

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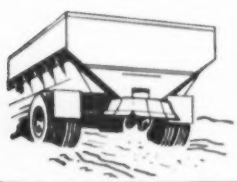
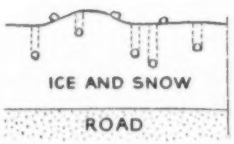
Half the cost! STERLING *Auger-Action* ROCK SALT is easier to store and handle. It spreads faster and goes further. Your own accounting will show the cost per mile for rock salt about *half* that of outmoded abrasive-chemical combinations.

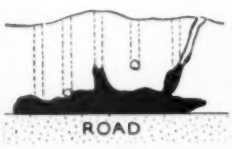
WHY STERLING AUGER-ACTION ROCK SALT DOES THE JOB BETTER!



STERLING *Auger-Action* ROCK SALT can be used in any mechanical spreader. Requires no special handling or treatment.



Each salt crystal, generating its own heat, quickly bores straight down through the entire crust of snow or ice.



As crystals reach pavement, they become brine which flows laterally, breaking bond between ice and surface.

Broken ice is easily removed with one pass of the plow or scraper. Heavy traffic spots clear themselves by friction of passing vehicles.

ORDER NOW . . . IN CARLOADS, BULK OR 100 LB. BAGS

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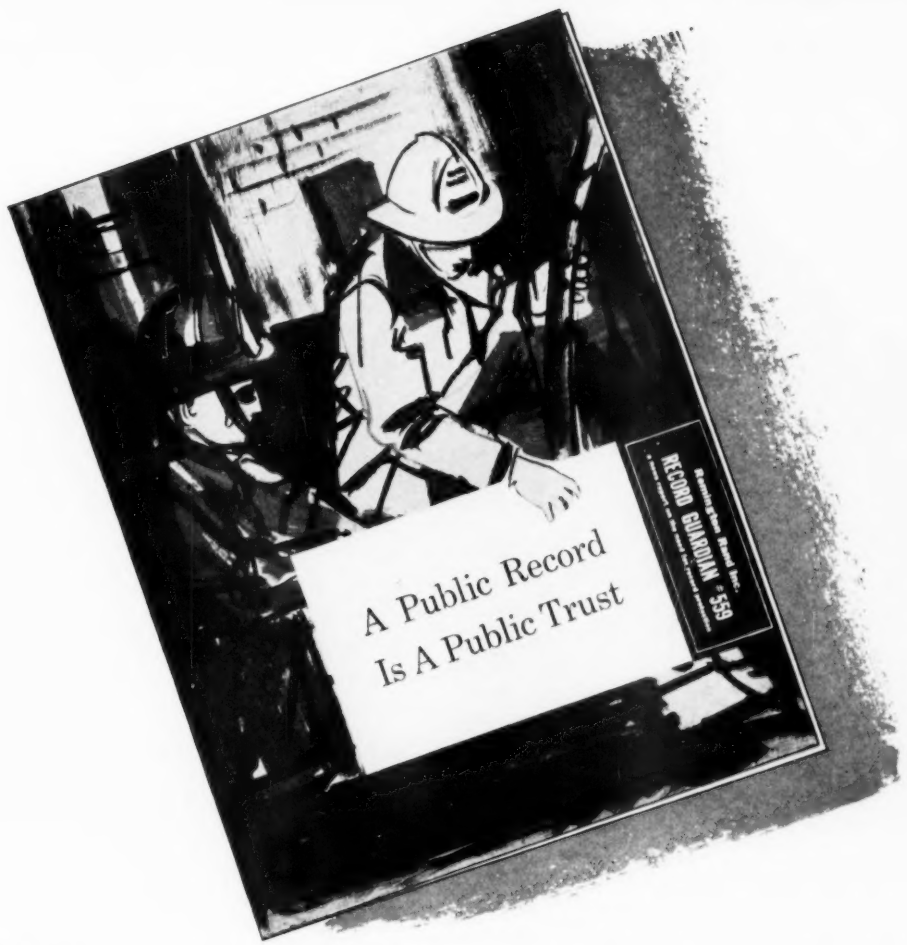

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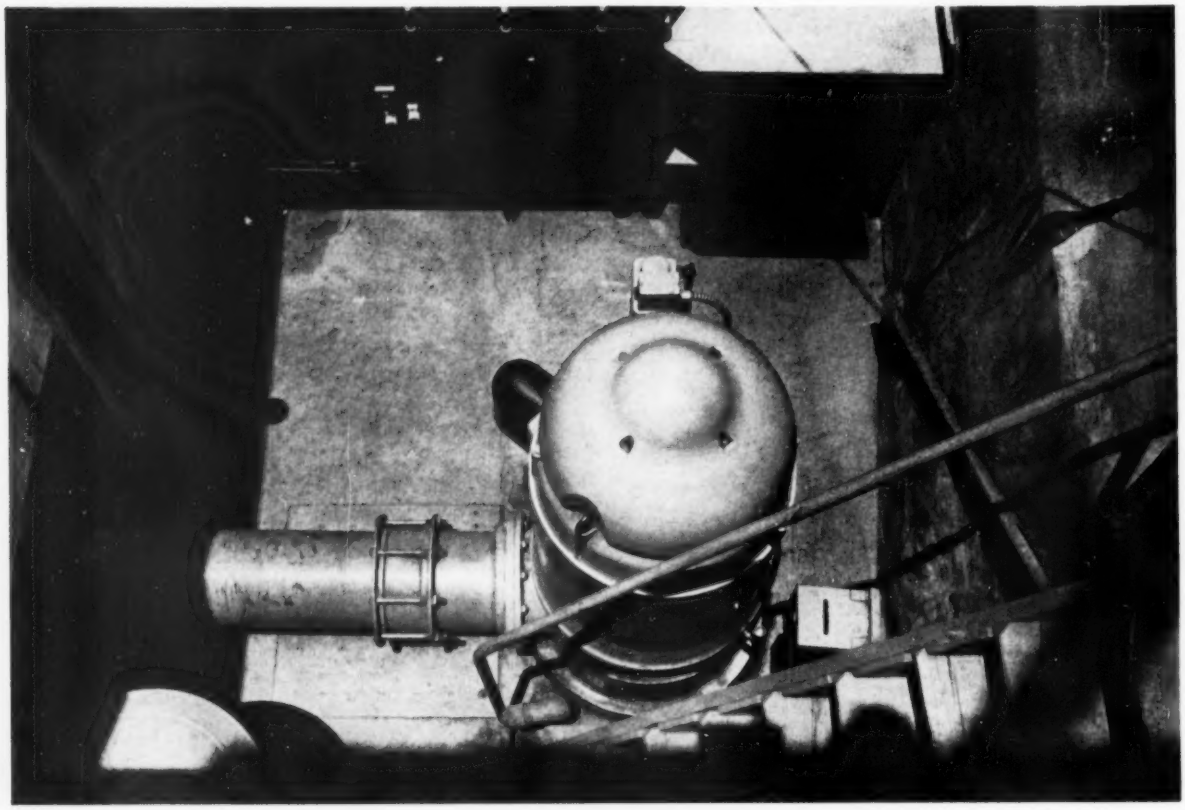

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Over 40 years ago, the Sunnyslope Water Company of Pasadena, California installed their first Johnston Vertical Turbine Pump. Since then Sunnyslope has used Johnston equipment exclusively. There must be reasons for this kind of product acceptance. Here are a few . . .

Vertical design saves as much as 60% floor space, to say nothing of head room.

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This is another example of the ability of Johnston equipment to handle all types of pumping jobs. Why not let our engineers consult with you on *your* special problem.

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JOHNSTON VERTICAL PUMPS

JOHNSTON PUMP COMPANY

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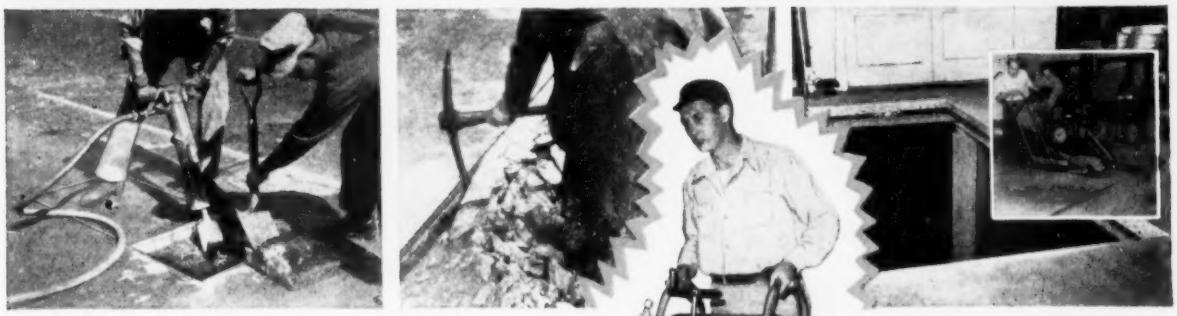

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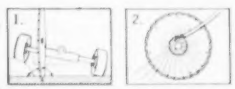
15 MODELS PRICED FROM $265

Quality is Consistent... Economy Certain with CLIPPER SUPERIOR DIAMOND BLADES

...guaranteed to..."Provide the fastest cut...at the lowest cost... with the greatest ease! "Clipper alone can supply every necessary metal bond...in over 36 specifications.

Only Clipper Features GUARANTEE EASE AND ECONOMY



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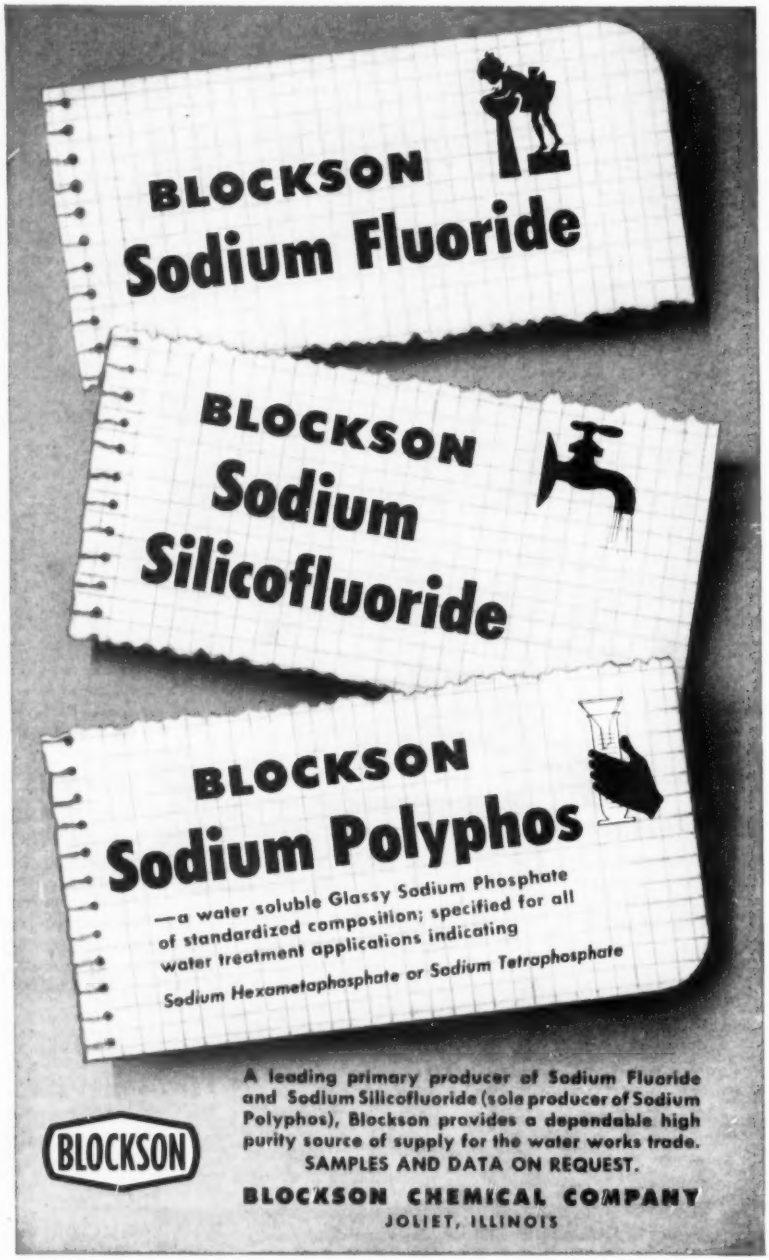
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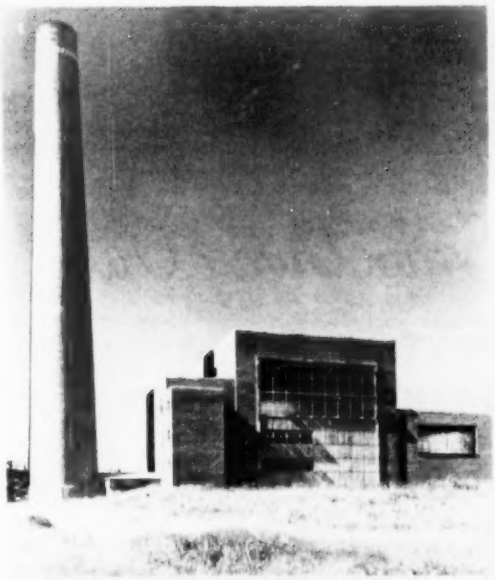
When you can get this ?

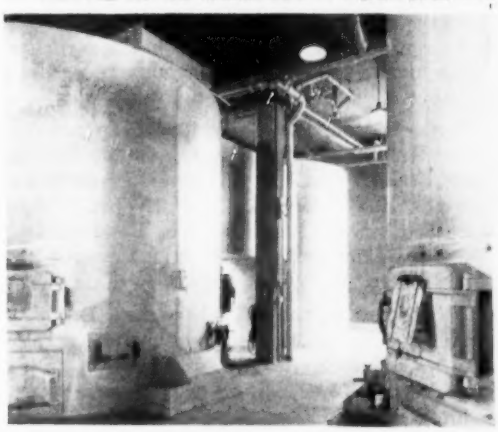


. . . when you can get a modern, efficient, nuisance-free incinerating *plant* designed by competent consulting engineers with the *incinerator equipment* designed by incineration specialists with more than 60 years experience serving communities in this way.

This, in brief, is what *we* have to offer: (a) thorough knowledge of municipal incineration; (b) plenty of experience in designing and constructing incinerator units; (c) a variety of modern basic types from which to start, including cell and mechanically stoked types; (d) ability to work with consulting and municipal engineers to properly coordinate the Morse Boulger Incinerator designs into their over-all plant designs.

Municipal incinerators are not and should not be 'packaged' plants. Each is designed in detail to meet local conditions, according to each community need.

This is what you get when you deal with Morse Boulger.



Photographs at right show the modern Incineration Plant at Lawrence, Mass.
Architects: Ashton, Huntress & Pratt
Engineers: Metcalf & Eddy
and, the operating floor of the two Morse Boulger Mechanically Stoked Incinerators: capacity 300 tons/24 hour on general municipal refuse.

We will have an exhibit at the A.P.W.A. Convention. We shall be very glad to have you drop in at Booth C-7 and discuss your incineration problem.

MORSE BOULGER DESTRUCTOR CO.

205K EAST 42nd ST., NEW YORK 17, N. Y.

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Smoothing Out

PONTIAC'S GARBAGE PROBLEM

This sanitary landfill is being built on the site of an old-fashioned, unwholesome open garbage dump in the progressive city of Pontiac, Ill. A Caterpillar HT4 Shovel spreads and compacts the old garbage, covers it with clean earth, and then compacts a solid surface for future development.

Pontiac chose the Caterpillar HT4 Shovel in the illustration only after thorough investigation. "My committee decided that the HT4 would handle our landfill project more efficiently than any similar equipment we studied," states Alderman J. A. Rennie, chairman of a committee appointed by Pontiac's mayor especially to learn about modern garbage disposal methods.

The bucket of the HT4 handles a lot of material fast, due to its 1¼-yard capacity and hydraulic controls which enable raising and dumping of the load simultaneously. Because of rugged construction, this machine can withstand extreme stresses and stay on the job year after year. The versatile unit can earn its keep at many other tasks as well: grading, excavating, handling bulk materials, snow removal, construction work and repair of city streets.

Your Caterpillar Dealer—who gives skilled service on all the equipment he sells—will gladly demonstrate the Cat* HT4 Shovel. Ask him to *prove* that this hard-working, long-wearing machine is a wise investment for your community.

Caterpillar Tractor Co., Peoria, Illinois

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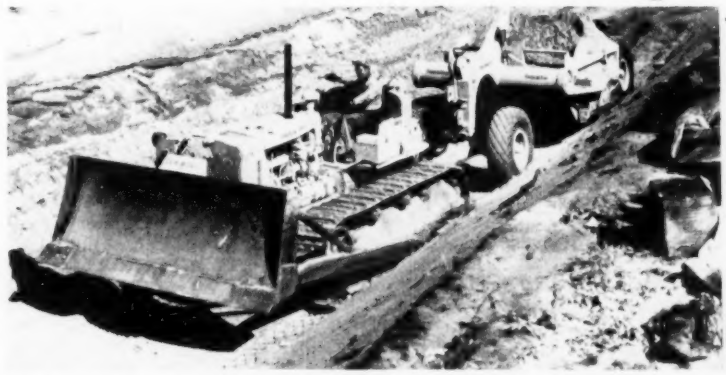
**NAME THE DATE...
YOUR DEALER
WILL DEMONSTRATE**

PUBLIC WORKS Magazine

VOLUME 84, No. 10

OCTOBER, 1953



● SANITARY FILL at Kansas City, Mo., uses scraper and bulldozer.

A SURVEY BY *Public Works*

CITY PRACTICES FOR REFUSE COLLECTION AND DISPOSAL

MUCH data regarding garbage and refuse collection and disposal practices by cities were accumulated by a recent survey by PUBLIC WORKS. The survey covers approximately 1,000 cities of all sizes, from New York City down. The report herewith is based on the first 618 returns—a more than adequate sampling.

Collection Data—Information in regard to collections showed that 323 of the cities collected garbage and rubbish with municipal forces, while 182 employed the contract method. This tabulation is based on garbage collection as primary and rubbish collection as secondary. Quite a few cities collected garbage by contract, for instance, and other refuse with municipal forces, or vice versa. In such cases, the practice employed for garbage collection was listed. A total of 26 cities reported private collection; and in a number of others, this method appeared to be the one used, but was not so tabulated due to lack of certainty as to the actual conditions.

Another question had to do with the percentage of homes covered regularly by the collection service. It appears that municipal collection results in a far greater coverage of homes than does contract collection. Of the 323 cities reporting municipal collection, 223 stated that 100 percent of the homes were served by such service. Omitting from consideration the 17 cities which did not reply to this phase of the question, 72.9 percent of cities with municipal collection service provided 100 percent coverage. This compares with only 55.7 percent of the cities with contract collection reporting complete coverage.

A collection coverage of 90 to 99 percent was reported by 50 cities —16.3 percent — having municipal collection; and by 34 cities—20.6 percent—having contract collection. In the cities having municipal collection, there were 8 providing 80 to 89 percent coverage; 7 with 70 to 79 percent; 6 with 60 to 69 percent; 6 with 50 to 59 percent; and 6 with less than 50 percent. For the corresponding groups in cities having contract collection, the figures were 7, 10, 4, 7 and 1. These data appear to bear out the general experience that municipal collection is preferable from the view points of sanitation and overall service to the community.

The steady growth over the past 13 years in municipal collection is illustrated by comparisons with similar surveys made by PUBLIC WORKS in 1940 and 1946. The percentage of cities using municipal collection increased from 36.0 percent in 1940 to 51 percent in 1946 and 60.8 percent in 1953; contract and private collection decreased accordingly.

Charging for Collection—In nearly 70 percent of the cities, the cost for garbage and rubbish is paid for out of the budget and not as a direct fee. Of 446 cities replying to this question, 317 reported that no direct charge was made for garbage and rubbish service, while 129 do make such a charge. It probably would have been interesting to tab-

● **DEMONSTRATION at Wood River, Ill., showed how sanitary fill is made.**

ulate the relationship between municipal vs. contract collection and the methods of charging for refuse collection service. Due to the work involved this was not done in the present tabulation.

Method of Disposal—Though too many cities still rely on the dark-age method of disposal of refuse by dumping, there has been a notable increase in the sanitary fill methods and probably in incineration. Of 549 cities reporting methods, 171 used the sanitary fill and 65 used incineration, the percentages being 31.2 and 11.8 respectively. Dumps, with 285 reported, had a percentage of 52.0; the remaining 28 cities reported such methods as grinding, discharge into a river and sanitary dumps, whatever these may be.

The methods of disposal reported in the survey show interesting developments as compared with the results of the 1940 and 1946 surveys. The data shown in Table I illustrate the rapid development of the sanitary landfill method; a decrease in the number of dumps; and a virtually static condition regarding incineration.

The questionnaire, as set up, did not provide space for disposal by hog feeding, but 25 cities wrote in this method of disposal. It is probable that it is employed by a great many more municipalities than are indicated here, probably most often in connection with the use of dumps. It is interesting that several communities mentioned the problems of cooking garbage.

Of special interest to users of sanitary fills was the question of the kind of equipment used and found most satisfactory for operating such a utility. A surprising 167 replies were received. Tops were the tractor and front-end loader combination with 78 mentions. Among these units mentioned prominently and frequently were the Bull-clam, the Traxcavator, the Hough loader and the Tractomotive tractor shovel. Following quite closely was the tractor-bulldozer combination with 49. It is possible that reporting was not precise and that the entire 127 units should be considered as a single general group.

Table I—Methods of Refuse Disposal by Cities

	Incineration	*Sanitary Fill*
1940	14.6%	6.7%
1946	15.6%	11.0%
1953	11.8%	31.2%

A combination of a dragline, crane or shovel with a tractor-bulldozer unit was well up in popularity with 27. Other units mentioned included dragline or clamshell 4; bulldozer and scraper 6; crane and front-end loader 2; and trencher and front-end loader 1.

Amount of Garbage—As usual, an effort was made to obtain information on (a) total amount of garbage and refuse collected per person per year; (b) the percentage of garbage contained in the mixture; and (c) the weight of garbage. The results are inconclusive.

Though this question was answered by a good many cities, the Editors assumed the prerogative of selecting those which appeared to be based on especially sound data, and on this basis the amount of garbage as reported by 49 cities seemed most in line. The figures given varied from 94.5 pounds per person per year to 1,560 pounds. The median was 280 pounds. Newark, N. J., reported 94.5 lbs.; Baltimore, Md., 188 lbs.; Temple, Texas, 583.6 lbs., and Garden City, N. Y., 874 lbs. The average reported for the 49 cities was 362 lbs. per capita per year or 1 pound per day.

In responding to the question "What percent of the total was garbage?", answers were even more "all over the map." About one-fourth of those replying gave the percentage as less than 25. The remainder were just about evenly divided over the range of 25 percent to 80 percent of the total being garbage.

Further illustration of the difficulty of reconciling the replies is given by a few quotations from the returns, as follows, all referring to annual production per person per

(*Continued on page* 157)

● **TRACTOR and front end loader excavates, compacts refuse and backfills.**

Phoenix Meets the People

● TYPICAL group attending one of the "Know Your City" forums held in Phoenix.

DEAN SMITH

LIKE the citizens of most American muncipalities, the people of Phoenix, Arizona, seldom attend City Council meetings . . . seldom bother to find out how their city departments operate . . . seldom take their problems and suggestions to the people who can best help them. And, like most city councils, the Phoenix governing body wondered whether it was conducting the kind of administration that best suited the needs of its citizens.

Because of these problems, the City of Phoenix conducted a series of nine "Know Your City" forums during April and May of 1953. The meetings proved to be so successful that Phoenix now plans to make the series an annual event.

Mayor Hohen Foster and the Council had always encouraged the public to attend council meetings at the City Hall, but few people ever showed up. So the city fathers decided to go to the people. Starting with the first week in April they held public meetings each week—one in each of nine sections of Phoenix.

Eight of the meetings were conducted in schools and the other was held in a Parks and Recreation Department building. To insure good attendance, the Council launched an advertising and promotion program that would have done credit to an enterprising advertising agency.

When the plan was announced, Phoenix newspapers, radio and television stations gave it enthusiastic play. Editorial comment was unreservedly favorable, and editors and broadcasters urged people to attend in force. School principals in the areas concerned sent meeting notices home to parents of the children. Handbills were printed and circulated to nearly every home. The City Clerk's office mailed out hundreds of letters inviting people to attend and bring their friends.

● CITY Manager of Phoenix, Ray W. Wilson, sparked the program.

C. A. Esser, assistant city manager, made arrangements for the "Know Your City" meetings. He provided seating for Mayor Foster, City Manager Ray Wilson, department heads, and council members at the front of the auditorium, with conveniently placed microphones for the speakers. Other microphones were placed about the auditorium for the use of those wishing to ask questions.

Anticipating the fact that many people might be shy about standing up and questioning the assembled city leaders, the council arranged to have local newspapers carry coupons in connection with their news stories. These coupons said "My main questions about our city are:" and space was left for readers to list several questions to mail to Mayor Foster.

Starting the Meetings

The mayor used these questions, mailed in advance of the meeting, to start the discussion after he had introduced members of the city government and stated the purposes of the meeting. Should the question deal with street paving, Foster called on the superintendent of streets for an answer. Questions on stop lights or traffic control went to the traffic engineering director, and so on. Before the written questions had been covered, the audiences were at ease and ready to start firing questions from the floor.

The council made it clear in the advance publicity that the assembled experts would try to answer almost any question—excepting those previously covered at the same meeting or queries obviously intended as heckling. It was also stressed that

(*Continued on page* 118)

PRESCRIPTION FOR WINTER-COATED STREETS:

EXPERIENCE, EQUIPMENT, SALT AND TWO-WAY RADIO

JOHN V. LEWIS,
Director, Division of Maintenance & Operation, Department of Public Works, Rochester, N. Y.

OUR winter routine is divided into snow-plowing, snow removal and icy pavement protection. In Rochester, this is a big undertaking, involving expenditures up to or in excess of $700,000. Our organization for snow removal and ice control is one of the best manned and equipped in the United States; it is the product of many years of experience in combating hard winter conditions. And it is appreciated by our citizens because it prevents accidents and keeps traffic moving without serious delays.

Weather Bureau reports indicate that a snow cover of one inch or more exists for 80 to 120 days each year. The annual seasonal snowfall averages about 76 inches. Occasional storms will deposit snow up to 20 inches deep in a single 24-hour period. With an area of 36 sq. mi., Rochester has 647 miles of streets and 895 miles of sidewalks which are routinely protected against winter hazards.

The operation of snow plowing is divided into three phases. Department personnel, using city-owned equipment, are assigned to plow 282 miles of streets, including those in the central business district and arterial routes. Hired private trucks, equipped with city-owned plows, handle the other streets, which are mainly residential. A reserve of equipment is held out for unusually severe storms.

Sidewalk plowing is done by contract. The city is divided into fourteen districts—thirteen regular and one special. The distances to be plowed in these districts vary from 28 to 107 miles. The contractor must have sufficient equipment and personnel to meet the requirements of whichever district he is awarded the contract for.

Icy pavement protection is performed by a separate departmental organization which is on duty 24 hours a day and seven days a week during the five winter months. In all, 367 miles of roadways are treated with CC grade rock salt to which one percent Nalco inhibitor has been added. This mixture is distributed by mechanical spreaders.

● **SALT SPREADERS** are mounted on 8-ton all-wheel-drive trucks shown above.

● **ROCK SALT** is loaded into the 8-yard trucks from a stockpile, using a crane.

When removal of snow from the roadways of the central business district is necessary, this work is performed by snow blowers. The snow is loaded into dump trucks, hired from private owners, and transported to the Genesee River.

Equipment Used

All of the 125 roadway plows are the property of the department. These are Good Roads Series 121 reversible blade plows. The larger 5-7 ton capacity trucks mount plows

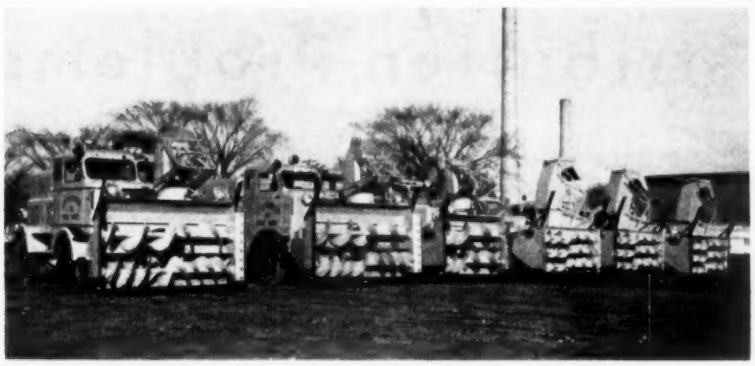
with 11-ft. blades, while the 3-5 ton units carry 10-ft. blades. The heavy duty plows are Good Roads Series 721 one-way units, equipped with 10-ft. blades. Plow lifts are either Blackhawk hand hydraulic type, or National "Snowlift" power hydraulic units. These power lifts have proven very satisfactory since their introduction several years ago.

In general, the contractors on sidewalk snow plowing employ various makes of wheel type tractors, equipped with special Vee type plows. All-wheel drive Jeeps, carrying special bulldozer types of plows are used to a limited extent.

The snow blowers are Sicard and Klauer. There are two Sicard Snow Master units and one Snow Master Junior unit. There are three Klauer Snogo Model LTR units.

The twelve mechanical type spreaders used for distributing rock salt are Baughman units; each has a capacity of eight yards. A single spinner disc, mounted at the rear, is driven by a power take-off on the transmission of the 8-ton capacity trucks. The salt is fed to the disc by means of a narrow cleated conveyor belt set beneath the bottom taper of the steel body and driven by the power take-off unit.

● **BIG PLOWS for plowing heavier snows from business and residential streets.**



● **TWO TYPES of snow blowing equipment which are used for heavy snowfalls.**

Dispatching of personnel and equipment is done at two points. A central control station is set up at the Portland Avenue Yard of the sub-Division of Street Cleaning with the auxiliary control station located at the Dewey Avenue Garage. This garage is responsible for servicing and repairing all departmental automotive equipment. Master control boards are installed at these two locations, showing the various routes and the equipment and drivers assigned thereto. Blank spaces for the recording of the beginning and endling of daily operating schedules are provided on these boards.

Weather Bureau Contact

The dispatcher on duty at the central control station maintains hourly contact with the local station of the Weather Bureau. The departmental inspectors in the field contact this dispatcher hourly and report their observations to him, receiving in return the reports of the Weather Bureau. The dispatcher keeps a record of information which he gives out or which is received from the Weather Bureau, the inspectors, the local Police Bureau, and the Rochester Transit Corporation.

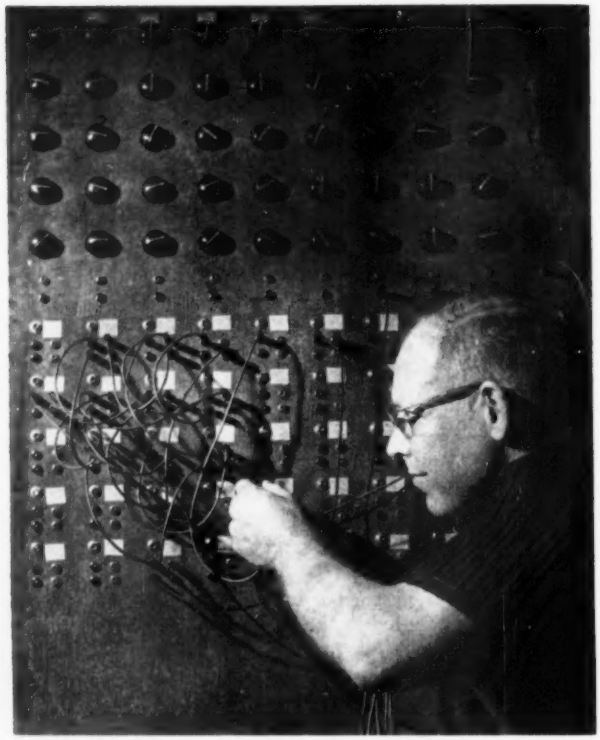
When it begins to snow or sleet, the salt spreaders are dispatched over their routes. One application of rock salt will generally melt a light fall of snow or remove a thin coating of ice from the pavement. However, if snow continues to fall until it is one inch in depth, the dispatcher notifies the headquarters staff who issue necessary orders to the central and auxiliary control stations. When two inches of snow have fallen, the roadway and sidewalk plows are usually ordered to begin their scheduled operations.

After the roadway plowing is completed, a second application of salt is made to melt the snow that remains on the pavement. If the snow continues to fall and attains a greater depth, all plowing routes are covered for one or more additional trips, with short intervals of rest for truck drivers and garage attendants. Unless the storm is very severe, two trips will suffice to push the snow to the curb and permit free flow of traffic. A snowfall of four inches or more requires its removal from the central business district and this is done by use of the snow blowers and hired trucks. Crosswalks are cleaned by hand gangs as is the area in front of churches and funeral homes.

Plowing of sidewalks follows the same schedule as that for roadway plowing insofar as notification of the supervisory personnel and inspectors is concerned. The plows make their first trip when two inches of snow have fallen and additional trips as required.

Salt is delivered by truck from the International Salt Company mine at Retsof, about thirty five miles south of Rochester. It is stockpiled in the open and in lots of one to two thousand tons at the Portland Avenue Yard. The inhibitor is mixed with the salt by means of a crawler crane and clamshell bucket unit which also loads the Baughman spreader units. The 367 miles of streets which are salted are divided into routes which can be covered in a total period of three hours. The Rochester Transit Corporation maintains its own personnel and equipment for salting bus stops with material furnished by the City. The total quantity of salt distributed during a normal winter season is about 16,000 tons.

(Continued on page 92)



● SMALL fifty-circuit calculator, using direct current, designed by Mr. Wolfenson, is low in first cost and flexible in operation.

HOW ELECTRIC CALCULATORS SOLVE Water System Distribution Problems

GEORGE W. REID,
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and
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Water works engineers are giving more attention to the solution of hydraulic distribution system problems by utilizing electric network calculators. These calculators afford a method of analyzing complicated systems with great rapidity, as well as high accuracy, and in many instances they have supplanted conventional methods entirely.

Since the distribution network is the most expensive portion of a water supply system, determining its behavior by the best available method is an economically sound practice. Generally, a distribution system does not develop according to any predictive pattern—it "just grows." Unfortunately, any addition to a given grid of interconnected pipes, or any alteration in the performance of a component pipe, will affect the operation of the entire system. Therefore, any proposed change in an existing system should be investigated.

Because most of the conventional techniques used involve tedious trial-and-error analyses which require a series of lengthy calculations, efforts have been made to solve such problems by the use of hydraulic or electric models, a number of which have been successfully built and used.

Conventional methods of solving hydraulic distribution system problems have involved the use of successive approximations, such as the Hardy Cross system and its modification (1, 2, 3, 4). In such solutions the relation between head loss **h** and discharge, **Q** is:

$$h = rQ^n \qquad (1)$$

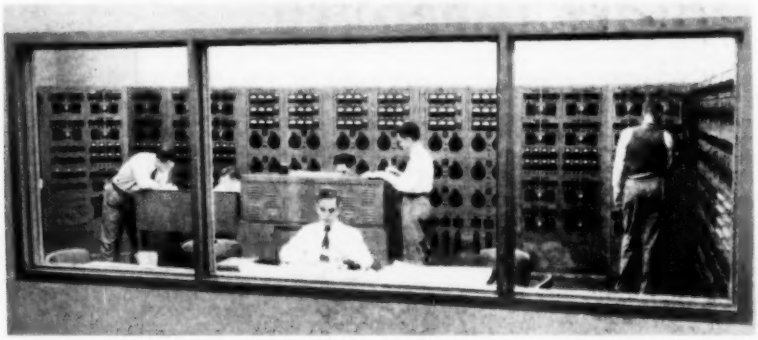
in which **n** is an exponent whose value is dependent upon the Reynolds Number and may vary between the limits of 1 (for laminar flow) and 2 (for turbulent flow). In the usual system, however, the value of **n** lies between 1.75 and 2.00, and in much of the work previously performed a value of 1.85 has been adopted. This is true in the Hazen-Williams formula, which is commonly employed. The value of **r** is a constant for each pipe, being dependent on the size, length, and roughness of the interior of the pipe. It is usually called the resistance factor.

In the hydraulic models which have been built, pipe elements are usually represented by interconnected tubes wherein the pressure is measured by piezometers at the junctions, and the discharge is measured volumetrically. The friction losses in these models are made to correspond to the prototype with suitable scale relationships by employing a variety of devices to lose energy. Gavett (5) used small, graduated orifices in the tube element and produced a relationship in which $n = 2$. Davis (6) used rounded-edge capillary tubes and reduced the **n** value from 2 to 1.85.

Thomas (7) achieved the same effect by adjustable pinchcocks. These systems were small and were greatly affected by viscosity and temperature, as well as by a tendency to air-bind.

Electrical Methods

The A-C network calculator, or the D-C network calculator, has given engineers a new tool to use in solving distribution system problems. The network calculator contains all of the elements required to represent a power system: resistor-reactor circuits for transmission lines, transformers, loads and the like; condenser circuits for line-charging capacity; and voltage sources for system generators. All of these elements are easily adjustable in magnitude and are so arranged that they can be connected quickly into any form of network desired. The calculator of the Georgia Institute of Technology is one of some twenty-two calculators available in the United States on a rental basis of one hundred dollars per day.



● **ELECTRIC calculator owned by the Georgia Institute of Technology is one of about twenty-two calculators available to users on a daily rental basis.**

In the solution of a hydraulic distribution system problem, the network calculator is used simply to simulate the hydraulic system. Considering the basic hydraulic and electrical equations:

$$h = rQ^n \quad \ldots\ldots (1)$$

$$E = RI \quad \ldots\ldots (2)$$

in which: **E** is voltage drop; **I** is electrical current; and **R** is resistance.

It can be seen that a rough analogy exists between the two systems. Pressure or head is analogous to voltage, pipe resistance to electrical resistance, and discharge to current. Thus, if an electrical network is set up with the same connections as a pipe network (with the branch electrical resistances in proportion to the pipe resistances), the head loss and the analogous voltage drop will vary with the flow and current, respectively. The analogy is not an exact one, however, because the head-discharge relationship of an electrical circuit is linear. The analogy is exact only in the case of laminar flow, where $n = 1$. The primary difficulty to date in applying the analyzer to distribution system problems has involved devising ways to overcome this nonlinear relationship. McIlroy has developed an electric analyzer employing nonlinear resistors specifically for water distribution systems. In water distribution problems it makes no difference if A-C or D-C calculators are used. A small fifty-circuit D-C calculator has been designed by L. B. Wolfenson which costs, exclusive of power supply and meters, only $500. In Figure 1 is shown a typical hydraulic network. This same network is pictured electrically in Figure 2.

Network Studies

The basic problems in network studies are:

(1) To represent faithfully the conditions of discharge and pressure;

(2) To make these representations quickly, noting the effects on the systems of changes in various elements; and

(3) To do these jobs economically.

All of the investigators utilizing network calculators have sought, in one fashion or another, to satisfy these requirements.

The first investigation utilizing a calculator for the solution of hydraulic problems was conducted by Camp and Hazen at the Massachusetts Institute of Technology in 1934 (9). They developed, mathematically, the analogy between the hydraulic and the electrical systems. The nonlinear relationship, referred to previously, was overcome by successfully adjusting the resistances of the instrument, thus obtaining the required value of 1.85 for **n** (10).

(*Continued on page* 112)

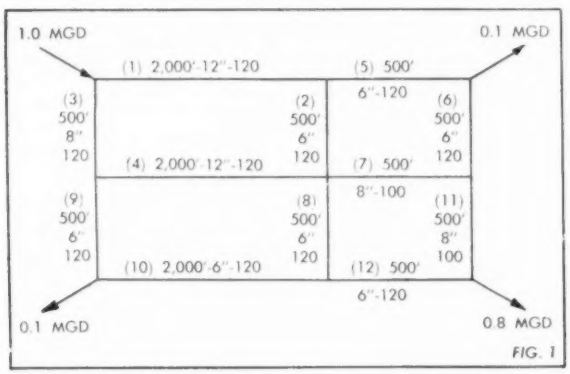


FIG. 1

● **TYPICAL hydraulic network showing length and size of lines and flow coefficient, with distribution of flow based on 1 mgd in twelve elements, one input and three takeoff lines.**

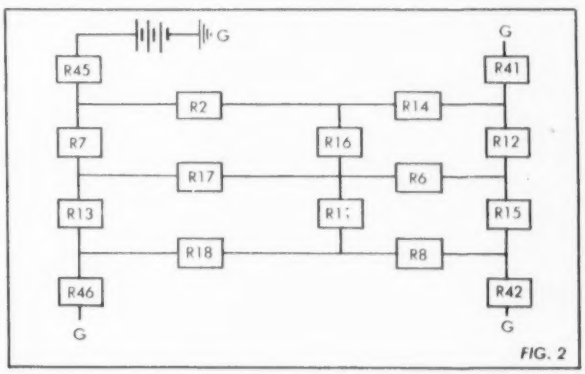
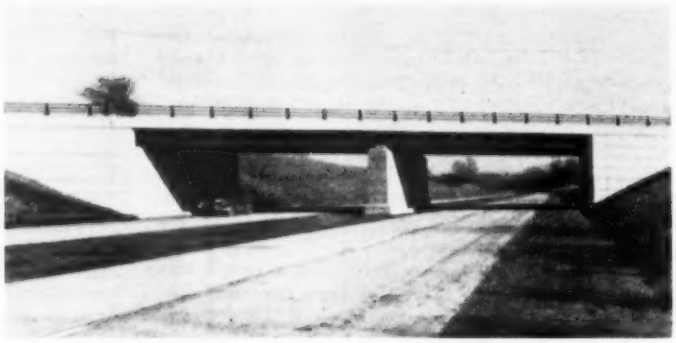


FIG. 2

● **SAME network as the one at left is pictured electrically. High and low numbers represent high and low resistances. Compare also with information presented in Table 1, page 112.**

● ON SUCH heavily traveled roads as the Wilbur Cross Highway, it



is necessary to have high-type bituminous gravel shoulders for safety.

HOW TO GET IMPROVED SHOULDER CONSTRUCTION and MAINTENANCE

A Contribution from the Connecticut Highway Department

THE definition of shoulders for the American Association of State Highway Officials as stated in the policy on maintenance of shoulders is:

"The term 'shoulder' refers to the graded area or surface of the roadway adjacent to the pavement which gives lateral support to the road surface and can be used by traffic in an emergency. The shoulder surface should at all times be kept properly maintained for safe deceleration of traffic and should be capable of sustaining the weight of the average vehicle using the highway."

It is quite generally conceded that Connecticut is one of the most shoulder-minded states in the east. With the exception of the Merritt Parkway and a few other roads, all state maintained highways in Connecticut have hard surfaced shoulders four to five feet wide on two lane lesser traveled roads, and eight to ten feet wide on heavy traffic two lane, four lane and divided highways.

Connecticut's early shoulders were an integral part of the roads. These shoulders, which were untreated, varied from two to five feet wide, while the travel path of "telford" or stone base averaged about sixteen feet. The material used in fills for shoulders was specified to be of a selective type but nothing was mentioned about the shoulder material to be used in cut sections. The result was that the original soil served as the shoulders in cuts. Even the so-called selective material was not of the best compared with present day standards.

While the original travel path of these older roads rarely exceeded sixteen feet, their widths were reduced further at times by the breaking down or disintegration that occurred along the inside edge of the untreated shoulder. During the spring periods, with the frost leaving the ground, the shoulders became soft and furnished little opportunity for safe travel. Continual maintenance was required in the dragging of the shoulders and the replacement of material washed from grades after each period of wet weather.

With the increased traffic beginning in the early twenties, it became apparent that much of the existing road system constructed prior to that time was inadequate. Reconstruction of the whole network was beyond expectation due to lack of funds. With the following three objectives in mind, the original untreated shoulders were stabilized and surface treated with bituminous materials:

First: To gain additional width for travel at a minimum of expense.

Second: To reduce the continual expense of maintaining the untreated shoulders.

Third: To strengthen the edges of the existing pavements.

The conversion of the original shoulder area to travel path necessitated gradual widening to provide new shoulder width. This work was done by maintenance forces.

For the past thirty-five years on all new construction or reconstruction projects, surface treated gravel shoulders have been standard on all types of Connecticut state highway pavements. It is possible to obtain good quality bank run gravel in most sections of Connecticut and these shoulders have been quite satisfactory except that patching is required once or twice a year and surface treatment needed each year or every other year.

Parkway Experience

Before the Wilbur Cross Parkway was constructed it had been determined from experience on the adjoining Merritt Parkway that shoulders were required on parkways for use in emergencies and it was felt that a higher type of shoulder than surface treated gravel was desirable for such roads. The higher type shoulder surface was needed for safety due to the heavy traffic. Oil gravel shoulders require constant maintenance and the presence of crews and equipment which create a potential hazard and delays to traffic on these heavily traveled highways. For these reasons bituminous concrete shoulders were constructed along the Wilbur Cross Parkway, beginning in 1941. At first these were three feet wide and later they were increased to eight feet and then to ten feet. There has been little maintenance required on these shoulders since. These shoulders on the Parkway in addition to serving as an adequate area for general emergency parking, have been a wonderful benefit during snow and ice storms. This additional width from which snow can be plowed back provides room for cars to pull off the travel path when they are in difficulty due to iced-over windshields, defective wind-shield wipers, engine trouble and other winter difficulties. The shoulders are also of advantage in

snow and ice storms on grades when some cars loose traction due to smooth tires.

After the construction of the bituminous concrete shoulders on the Wilbur Cross Parkway, experiments were begun with bituminous surfaces by mixed-in-place methods. It was thought these might be less costly to construct and would give a surface similar to bituminous concrete which would require little maintenance. This type of shoulder construction was tried among other places, on the Wilbur Cross Highway between Hartford and the Massachusetts State Line. The results for this heavy traffic highway have not been satisfactory, the maintenance to date required exceeding that of oiled gravel. Several additional miles of what we termed "bituminous stabilized gravel shoulders" were constructed on highways in addition to the Wilbur Cross Highway. Various types of bitumen were used and the gravel and bitumen were mixed-in-place with a Seaman mixer.

Cost Data

Department records on construction and maintenance costs of various types of shoulders provide a comparison of maintenance costs on typical projects of surface treated gravel shoulders, bituminous stabilized gravel shoulders and bituminous concrete shoulders on a gravel base. Average construction costs per square yard of these three types of shoulders were as follows: surface treated gravel 73 cents; bituminous stabilized gravel 78 cents; bituminous concrete $1.33.

TABLE 1.—ULTIMATE COSTS OF DIFFERENT SHOULDER TYPES

	Surface Treated Gravel	*Bituminous Stabilized Gravel*	*2" Bituminous Concrete Wearing Surface on 6" Gravel Base*
Original cost per Sq. Yd.	$ 0.73	$ 0.78	$ 1.33
Present Average Yearly Maintenance Cost x 20 Yrs.	0.62	0.80	0.08
			$ 1.41
Seal coat at end of ten years			.15*
Estimated total cost per Sq. Yd. over a period of 20 years. Totals—	$ 1.35	$ 1.58	$ 1.56

*As it is reasonable to expect that at least once within the twenty year period it will be necessary to seal the bituminous concrete wearing surface, fifteen cents per square yard should be added for this work.

The same records reveal the following maintenance costs:

The maximum age of the sections of surface treated gravel selected for this study is six years. Average yearly maintenance cost per square yard has been $0.031.

The maximum age of the sections of bituminous stabilized gravel selected is three years. Average yearly maintenance costs per square yard has been $0.040.

The maximum age of the bituminous concrete selected for this study is eleven years. The average yearly maintenance cost per square yard has been $0.004.

A comparison was made of the probable ultimate cost of each of these types of shoulders, combining original construction costs with maintenance costs and a life of twenty years, as shown in Table 1.

One encouraging feature of the bituminous stabilized gravel shoulders is the fact that the maintenance costs are going down each year; or at least the trend indicates this for the period of time that costs have been kept. Many states have found this type of shoulder very satisfactory both to construct and to maintain.

From the poor experience with the stabilized bituminous gravel shoulders on the Wilbur Cross Highway it was determined that, at least for parkways, high-type shoulders were essential.

There have been some experiments on a small scale with a port-

(*Continued on page* 156)

● **THIS IS what happens when shoulder construction is inadequate. Ruts are a hazard and expensive to maintain.**

● **GOOD SHOULDERS provide more travel width and reduce maintenance. Connecticut finds that their use pays off.**

How can we get

T. W. CADMUS,
Member ASME
Hamburg, Pa.

THE title above reflects a common question today, especially among small municipalities. Many such communities have found that land formerly used for dumping has developed value for industrial or residential uses. Former dumps must be abandoned; and, in addition, land available for dumping is becoming increasingly scarce. Typical of these conditions are the communities in the northern New Jersey area. Many of the commuting towns in this section have grown from two to five times in population over the past six or eight years. During this period, adjacent communities which previously permitted dumping by private collectors have themselves so grown that their dumping facilities have dwindled. To preserve the remaining areas for their own use, they have prohibited dumping by outside collectors. As a result, private and contract collectors have had to increase their charges because of the long hauls necessary for disposal. These conditions are typical of many metropolitan areas.

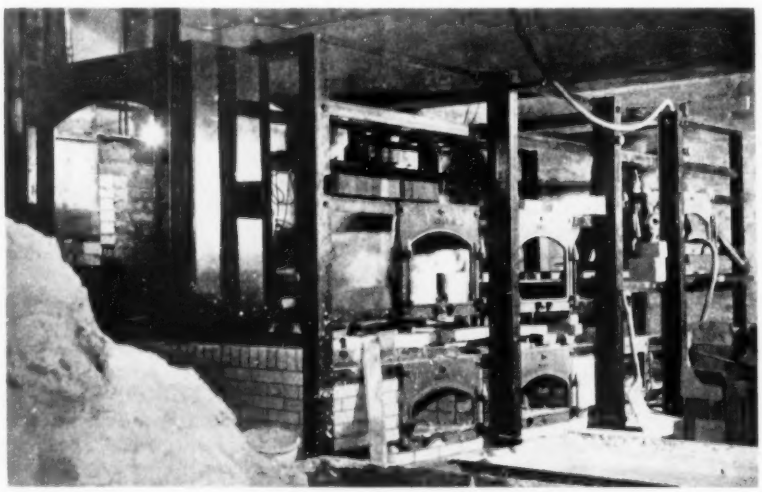
Many small municipalities faced with this disposal problem have hesitated to initiate an incinerator project because they fear that even the smallest incinerator is beyond their financial means. This need not be the case. It is entirely possible, even with today's high-cost market, to erect a municipal incinerator, using modern building materials, which will be neat, but not elaborate; will have proper capacity; and will operate without objectionable smoke, odor or nuisance. As an example of what can be done, in one community, the Lions Club sponsored a municipal incinerator as one of their civic projects. The total cost of the plant was less than $8,000. In another community, refuse collection and incineration is a one-man operation. The collector, when arriving at the incinerator, charges his load into it and proceeds with his round of collections.

The Greatest Need

The greatest need for small incinerator plants seems to lie in those communities having populations between 1,000 and 10,000, according to an analysis of the requests for information from civic groups, engineers and other officials. Many indicate that they are not interested in making (to use a well-known colloquialism) a "federal project" out of the problem. Some say they are in a position to provide local contractors to install foundations, building and stack, and even erect the incinerator with local labor. They need guidance to insure the selection and construction of an incinerator designed on sound engineering principles. All conclude by asking: "Can we do it economically?

The answer is an emphatic: "Of course you can."

There is no mystery in the design of an efficient incinerator. It is necessary only to provide the fundamental principles of combustion engineering—the three "T's"—time, temperature and turbulence. Mix the combustible gases with sufficient air and retain them in the incinerator—not in the flue connection or the chimney—for the time necessary for them to burn. Usually, there is sufficient heat values in municipal refuse to develop the necessary temperatures; if, rarely, there is not, auxiliary fuel must be used. Turbulence is required to insure that the gases are mixed thoroughly. To these, add definitive and positive control of the velocity of the gases and you have an incinerator which can be operated without producing any objectionable smoke, odor or fly ash.



● **WORKING parts of an incinerator furnace before finishing touches are applied.**

Location of the incinerator is usually of major importance. The mistake should not be made of locating the plant so far away that hauling costs are prohibitive. A sufficient area of ground is desirable, but excess area is not necessary. A favorable site may facilitate construction and operation. Good engineering advice and guidance are necessary, just as they are in all public works.

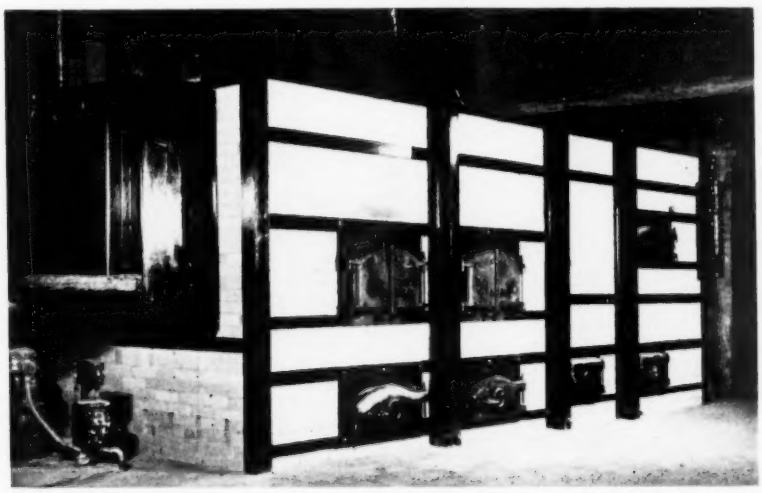
Questions & Answers

"Can we build an incinerator without a building?" The incinerator will operate just as efficiently without being surrounded by a building as it will in the most elaborate structure. Location and climatic conditions usually govern the needs for a building. Many incinerators throughout the south are operating without a surrounding building. In such cases, however, wire barriers are provided to prevent blowing papers on a windy day

INCINERATION?

or a small shelter is added to protect the operator from rain. Where appearance is not a factor, some incinerators are enclosed with economical corrugated steel or asbestos buildings.

"Do we need such a tall chimney?" Not necessarily; the height of a stack or chimney is determined by the necessity to provide sufficient draft to overcome all resistance in the incinerator and move the anticipated maximum volume of gases to atmosphere. The area of a chimney is determined by the need to handle the maximum volume of gases at a reasonable velocity.



● **SAME UNIT after facing has been added and connections made, ready for work.**

Tall chimneys are normally natural draft chimneys. They require very little attention or maintenance. To overcome a tall chimney, a Venturi chimney can be used. However, such a chimney will require a forced draft fan and motor in constant operation while the incinerator is under fire.

"How large a plant do I need?" That, of course depends upon your population and other factors amongst which is whether your town is the shopping center for surrounding communities. If yours is a normal community with the average number of stores, a good rule of thumb measurement, based on an 8-hour operating day, is: For a population of 1,000 provide 250 lbs. per hour; 2,000 will require 500 lbs. per hour; 4,000 population, 1,000 lbs. per hour; 6,000, 1,500 lbs. per hour; 8,000, 2,000 lbs. per hour; 10 000, 2,500 lbs. per hour. Any unusual condition suggests that all material be weighed for perhaps a week to determine accurately the quantity of refuse being produced.

"Suppose we build to take care of our present needs, what happens should we continue to grow?" Most incinerators are designed to operate on an eight-hour day. Some allowance should be made in determining the size to build for the normal growth of a community. When the eight-hour capacity has been reached, additional refuse can be disposed of by operating a longer period of time. Some communities are erecting an incinerator plant of a normal size but a chimney of twice the size needed as insurance against a rapid or unusual growth. This permits adding a second burning unit when needed without the expense of building a second chimney.

"Why do some communities have incinerator operating troubles?" One difficulty being experienced by municipalities which have and are operating incinerators, is the fact that the character of refuse has changed quite radically in the last 10 to 15 years. Twenty years ago it was customary to base incinerator design on refuse composed of 65% garbage and 35% rubbish with an approximate moisture content of 55%. Twenty years ago that specification for municipal refuse was probably quite accurate. Today, however, we find that the character of the refuse delivered to a municipal incinerator plant has reversed itself and that instead of 65% garbage and 35% rubbish, refuse is now averaging between 60 and 70 percent dry rubbish and 30 to 40 percent garbage.

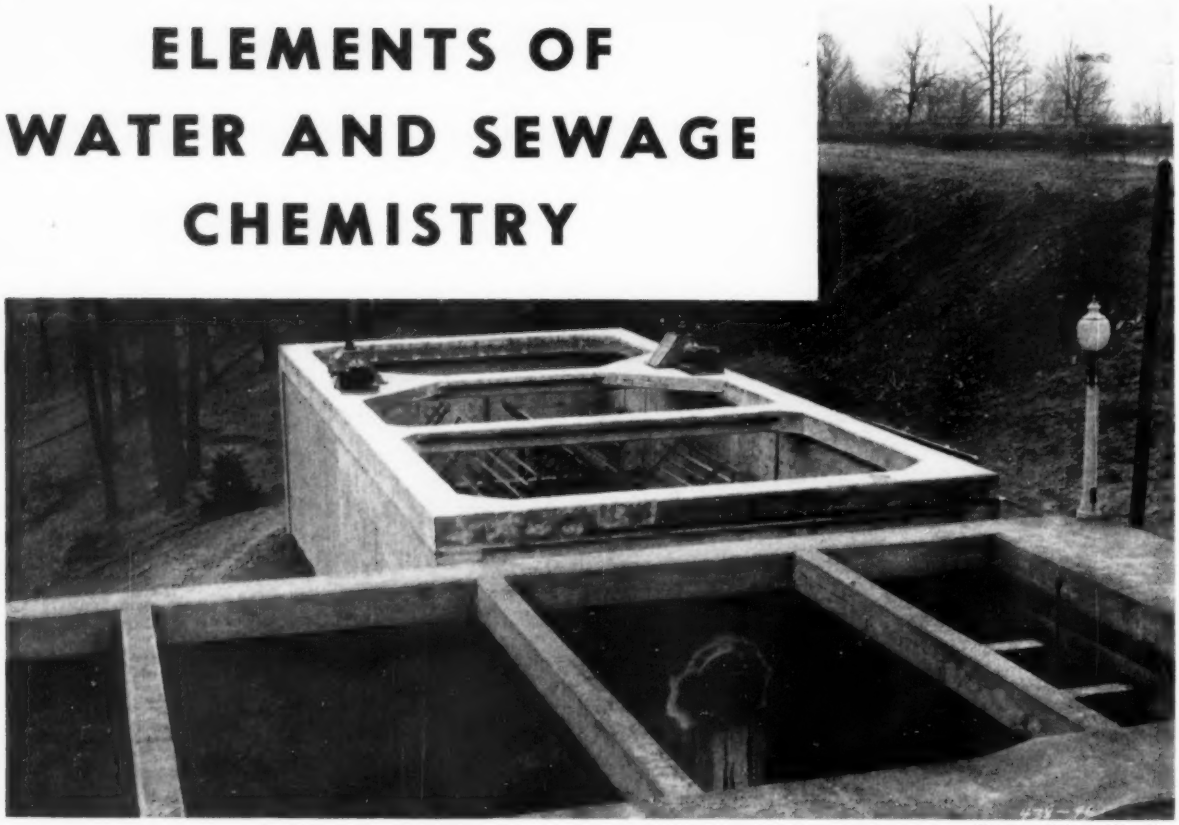
In designing an incinerator plant to handle 65% garbage and 35% rubbish, the heat release from such a mixture is taken into consideration in determining the size of the ignition chamber, the combustion chamber, the flues and the chimney. Thus, plants which were built twenty years ago may be suffering from high maintenance costs and inability to make capacity because they are now being asked to dispose of the same tonnage of materials of entirely different characteristics, and in larger volumes.

The drier materials are creating higher temperatures; the higher temperatures are increasing the volume of gases and since the capacity in volume of gases is fixed by the areas of the flues and the stack, the incinerators are handling their capacity in volume of gases but not in tons of materials.

(*Continued on page* 157)

● **TYPICAL, well-designed small incinerator for municipal refuse.**

ELEMENTS OF WATER AND SEWAGE CHEMISTRY



Courtesy Jeffrey Mfg. Co.

● **PROPER conditioning and preparation of water is essential before treatment. This is the Fairmont, W. Va., plant.**

A LIMITED number of chemicals are used in the treatment of water and sewage; and few, if any additional ones are used in industrial waste treatment. But intelligent use of these chemicals requires an acquaintance with many fundamentals of chemistry, though it is by no means necessary for a water, sewerage or industrial waste treatment plant operator to be a trained chemist.

Most of the chemicals used are compounds. A compound is a combination of two or more chemical elements. Water, for instance, is a compound of hydrogen and oxygen, and has the familiar formula H_2O. This means it is 2 parts hydrogen to one part oxygen. Common salt is another compound we all know about; in chemical language it is sodium chloride or NaCl. Elements are the simplest form of matter, and each element has a name and a symbol. This symbol usually, but not always, represents the first letter or the first and another letter of the name, which is often Latin or Greek. Generally used chemicals include: Sodium or Na; chlorine or Cl; hydrogen or H; oxygen or O; copper or Cu; iron or Fe; sulphur or S; magnesium or Mg; aluminum or Al; calcium or Ca; carbon or C; potassium or K; and manganese or Mn.

Each of these chemicals has a certain combining power or ability; that is, each will unite with some other chemicals in one or more specific proportions by weight. This property is known as *valence*. So far as the scope of this text is concerned, little consideration need to be given to valence since all dealings will be with known compounds. Each element or compound has a specific form, character and weight. Most of us are familiar with CaO, which is lime or calcium oxide and know it as a white powder; we know chlorine as a gas; and sulfuric acid, H_2SO_4, as a liquid. We are familiar with hydrated lime, which is quicklime to which water has been added. Its chemical formula is $Ca(OH)_2$, which is obtained by adding CaO to H_2O.

Thus elements or the compounds formed by them may be solids, liquids or gases. Some are acid, as H_2SO_4, which is sulfuric acid, and HCl, which is hydrochloric acid; others are alkaline, as sodium hydroxide, NaOH, the familiar caustic soda; and lime, either as CaO or $Ca(OH)_2$.

Atomic Weights

Each element has a certain and specific atomic weight. This weight is relative only and, except in a few cases, does not indicate how much any specific volume of the chemical element will weigh. The atomic weight of chemicals is based on an assumed atomic weight for oxygen of 16.00 and represents the true relative weights of the other elements. The atomic weight is important because the elements always combine in proportion to their atomic weights. Thus Ca and O always combine in the proportions of 40.08 parts of calcium to 16.00 parts of oxygen, which are the atomic weights of the two elements. This relation remains true even when pounds and ounces are used. And to make salt, 23.00 parts, pounds, ounces or grams of sodium combines with 35.46 parts, pounds, ounces or grams of chlorine. Any excess of either chemical will not combine but will remain unchanged

The atomic weights for all elements will be found in many handbooks and publications.

Specific Gravity and Temperature

The specific gravity of a solid or liquid is its weight as compared to water at a specified temperature and atmospheric pressure. A liquid or solid which has a specific gravity of 1.61 is 1.61 times as heavy as an equal volume of pure water. The specific gravity of gases is determined by comparison with the weight of an equal volume of air at the same pressure and temperature.

Density and specific gravity, as applied to solutions of chemicals, are not strictly the same, but for most purposes may be used interchangeably in representing the weight of a volume of liquid as compared to the weight of an equal volume of water. The temperature must always be specified. As a standard basis for specific gravity a temperature of 60° F is used.

For temperature readings, both the Fahrenheit or F and the Centigrade or C scale are used. In the F scale, freezing is at 32° and boiling at 212°, a range of 180°. In the C scale, freezing is at 0° and boiling is at 100°, a range of 100°. To change F to C, subtract 32 from the F reading, divide the remainder by 9 and multiply by 5. Example: 86° F; subtract 32, leaving 54; divide by 9 to get 6; multiply by 5 to get 30° C. To change C to F, divide by 5, multiply by 9 and add 32. Example: 25° C; divide by 5 to get 5; multiply by 9 to get 45; add 32 to get 77° F.

Mixtures and Compounds

A compound is a chemical combination of two or more substances, while a mixture is only that—a mechanical scrambling of the substances. The compound cannot readily be resolved into its original parts; a mixture often can be.

Outside agencies are sometimes needed to cause the chemical combination to occur, such as a spark, heat or light; but this is not always the case. Examples of the need for such outside agencies are as follows: Hydrogen gas and chlorine gas when mixed together and exposed to sunlight form hydrochloric acid or HCl. A mixture of two atoms of hydrogen and one atom of oxygen requires ignition to produce water. Copper filings and powdered sulfur must be heated to form copper sulfide.

Solutions and Suspensions

When a solid or a gas is dissolved in a liquid it forms a solution. An example of a solid dissolved in a liquid is sugar dissolved in coffee or aluminum sulfate dissolved in water. A water solution of chlorine is an example of a gas dissolved in a liquid.

There are some substances that do not dissolve, as Fullers earth or activated carbon. Where, as in these cases, the particles of the solid are spread or dispersed through the liquid in a finely divided state, the mixture is called a suspension.

Solutions are called dilute when they are weak, that is, when they contain a small amount of the dissolved material; and concentrated when very strong; or saturated, at which point the liquid is unable to take up any more of the solid or gas.

Standards for Solutions

For making tests, solutions must be of a standard strength. That is, a standard solution is one that contains a known weight of the material in a precise volume of solution. Standard solutions are usually expressed in terms of the normal system. A normal solution contains one gram-equivalent weight of that substance in a liter of solution. A 1/10 normal, tenth normal or N/10 solution contains a tenth of a gram-equivalent of the substance in a liter of solution.

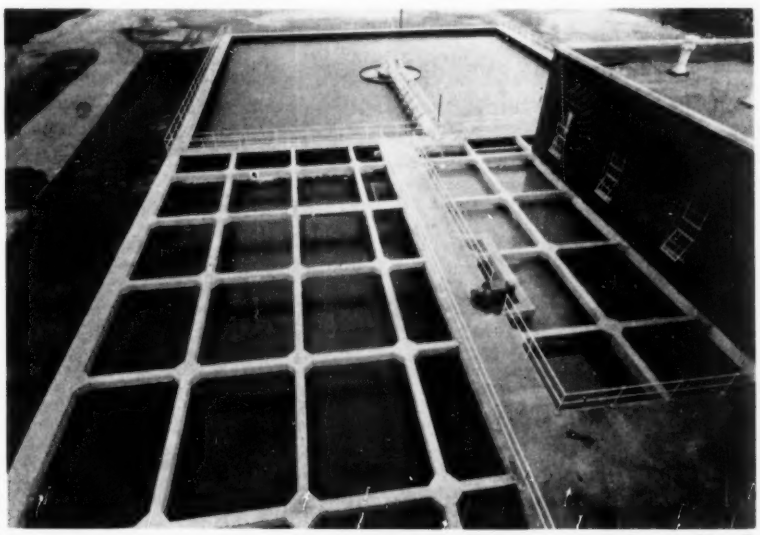
The gram-equivalent weight is based on the atomic weight of the constituents. The gram-atomic weight is the atomic weight of that substance expressed in grams. For instance, the atomic weight of sodium is 23.00 and the gram-atomic weight is 23.00 grams. This applies to all elements, depending on their atomic weights.

In a compound there are two or more elements and the molecular weight of that compound is the sum of the atomic weights of the elements. Thus, the gram-molecular weight is the sum of the gram-atomic weights of these elements. For instance, the molecular weight of CaO, lime, is the atomic weight of the Ca plus the atomic weight of the oxygen or 56.08. The gram molecular weight is 56.08 grams. The molecular weight of sulfuric acid, H_2SO_4 is the weight of two molecules of hydrogen, one molecule of sulfur and four molecules of oxygen, or 98.09. Its gram-molecular weight is 98.09 grams.

The gram-equivalent weight must be computed or taken from a table or textbook. These are related to gram-molecular weights as follows: For acids, the gram equivalent weight is the gram-molecular weight divided by the number of replaceable hydrogen atoms. Sulfuric acid, for instance, has two replaceable hydrogen atoms and its gram-equivalent weight is therefore one-half of its gram-molecular weight or 49.04. Hydrochloric acid, HCl, has only one replaceable hydrogen atom and its gram-equivalent weight is the same as its molecular weight.

A base is the oxide or hydroxide of a metal, as CaO, NaOH and FeOH. The reaction of an acid and

(*Continued on page* 156)



Courtesy Dorr Co.

● **WICHITA, Kans., municipal plant is designed to soften 32 mgd. of well water.**

PUTTING NEW LIFE in a DYING ROAD

NEWSPAPER clippings of 30 years ago gave high praise to State Highway Officials for their vision in building a permanent highway. Also, commendations were voiced by the car owners of the lower Kennebec River Valley and the mayors of Gardiner, Hallowell, and Augusta. This approval was occasioned by the completion of 2½ miles of U. S. Route 201 connecting the busy cities of Gardiner and Hallowell and providing an easier access to the Capital city of Augusta located 2 miles north of Hallowell.

This modern highway which created so much interest had a cement concrete pavement with two 9-foot traffic lanes. It also had 3-foot dirt shoulders which were to be travelled upon in case of an emergency. This highway was referred to by everyone as a permanent road and it was believed by many that it would need little repair and never have to be rebuilt. This was in 1923.

Thirty years ago, at the time this concrete paved highway was opened to traffic, it was not unusual for those who used it, to see not only motor vehicles and horse drawn wagons travelling the highway, but also to see trolley cars, loaded with passengers, travelling the trolley tracks close beside the highway and also long trains using the steam railway rails which were adjacent to the trolley tracks and, in addition, only a few feet away from the steam powered trains, were the freight and passenger steamers navigating the deep channel of the Kennebec River. These four modes of transportation operated side by side in 1923.

JOHN C. BURNHAM,
Assistant to Chief Engineer,
Maine State Highway Commission

Traffic on the river has diminished and today one sees only an occasional oil tanker or tug; there are fewer trains, and these are powered by diesel locomotives. The trolley rails have long since been removed; and motor traffic on the highway has increased to 6 times that of 1923.

As traffic increased in volume on this highway, its narrow lanes forced a gradual decrease in speed. This condition kept getting worse until the two narrow traffic lanes became so crowded that 25 miles an hour was the average speed. Relief from internal friction became a "must" and a study was made to determine what could be done to put new life into a dying road.

It was finally decided that widening the two traffic lanes would do the greatest good for the least outlay and that such a change could be made without an engineering survey or construction plans and without disrupting everyone living close to the narrow right-of-way.

After a careful study it was found that two 12-foot traffic lanes could be provided by utilizing the old trolley track area. This would still keep the widened highway within the present right-of-way. It was also found that the sight distance could be greatly improved at the two really bad spots by making fills each about 6 feet deep and 300 feet long. It was decided that these changes, plus a bituminous concrete surface would greatly improve the capacity of the highway and would represent the wisest expenditure of funds.

● **BACK IN 1923, this road, with its two 9-ft. wide lanes of smooth concrete, met all needs. Note trolley and railway tracks.**

● **THIRTY YEARS later the trolley tracks have gone and the added width has been paved. Railroad is still doing business.**

The area of widening on the old trolley roadbed had to be strengthened to support the new pavement. This was done by cement soil stabilization of 3000 feet of the old roadbed which, for that distance, was composed of excellent gravel. The remainder of the 2½ miles of the old trolley track was excavated and replaced with 24 inches of clean coarse gravel.

The necessary base widening was made late in the season and allowed to lay over the winter to effect a maximum of compaction. This same method was used with the two filled areas and when paving time arrived early the following spring, there was a solid foundation for the new pavement.

To stabilize the widened area of 3000 feet in length, 6 feet in width and 6 inches in depth, where the

(Continued on page 118)

HOW A SMALL CITY PREPARED A THREE-YEAR CAPITAL OUTLAY BUDGET

B. H. CRUCE,

City Manager, Pampa, Texas

"WHAT we need is a long range plan," the Department Heads would say everytime I questioned them about a future project.

"You are so right, but the City does not have the money to hire consulting engineers to provide us with a plan," I would always answer.

The problem came up so often that it became downright provoking. I had seen a number of very beautifully bound books called *The City's Master Plan*. And it was this type of plan stuffed with maps, charts and other drawings that I always thought of when someone mentioned "a long range plan."

For a small city, such a plan is almost an impossibility because funds are never available for such a project. However, after giving our problem more consideration, I decided that we could do something about it by putting in a lot of thought and effort of our own.

It was not a detailed over-all city plan we needed, but a general plan whereby we could estimate capital expenditures over a three to five-year period. To obtain the necessary information, the Department Heads and I felt we did not need a lot of maps and charts but we did need a good understanding of the City's growth problem. From such a study, we decided, we could project the City's capital expenditures for at least three years.

Starting the Job

With the enthusiasm of a three-year-old licking a chocolate ice cream cone, the Department Heads and I dived into the project once we had settled on our real need. We started work on the problem about forty-five days before commencing our current budget and completed the Three-Year Capital Outlay Budget sixty days after beginning our study of Pampa's future growth.

Such a project is not easy for a small city because the small city does not have the expert planners and advisers that are employed by the larger cities. Of our four Department Heads and seven Division Heads, only one has a college degree. None of them has had formal training in municipal administration or utility management. They are all practical men and hold their jobs because of experience and proved ability in getting the work done. Only one or two has less than five years experience as a Department Head or Division Head.

Another handicap for the small city is the fact that it is not customary to plan several years ahead. "Vote bonds only for current needs because we might have 'hard-times' later and won't be able to pay our taxes" is the usual cry of citizens. Pampa, however, has been an industrial community since 1927 and has outgrown a lot of the village thinking. It went through a boom when oil and gas was discovered in 1927 and in some instances past city administrations have looked very far ahead. Pampa today has a population of 18,000.

Nevertheless, no effort had been made to schedule the replacement of motor vehicles, street equipment, fire apparatus, drilling of new water wells, overhead water storage, etc. By doing these things, I am sure

● **TO SERVE a new 80-acre subdivision, this 12-inch sanitary sewer was installed with City equipment and labor. Cost of this and other lines for this job totals $50,000.**

● **NEWEST booster pump station is started by E. S. Lowery (left), Sup't., Pampa Water & Sewer Dep't., and Tom Peterson.**

● **EXTENSION OF storm sewer was made possible by a 1952 bond issue. Several other extensions were made during 1953.**

we will make it easier on the City Council as well as on the city employees responsible for looking after the City's needs.

In starting our project, the first thing done was to discuss the problem thoroughly with the Department Heads at our regular staff meetings, considering the problem from various angles. It was at one of these meetings that we pinpointed our objective. After deciding upon the objective, we discussed the problem each time we met and over every cup of coffee. Each Department Head was, of course, interested most in the items affecting his department. It was my job as city manager to try to coordinate the efforts of everyone in order to arrive at a well balanced program.

The First Question

The first question to be solved was the probable size and population of Pampa three years hence and how much it would grow each year.

After a thorough discussion of this question in light of the growth in size and population for the past three years, each department head was asked to study the matter for two weeks and then present his own estimate.

In the meantime, I contacted several building contractors, building supply houses and members of the local real estate board. Each of the persons contacted was told about our project and was asked to make a prediction about Pampa's growth. The Water Superintendent made a careful study of water meter installations over the past ten years. The Tax Collector studied the tax rolls and charted the number of tax payers over a five-year period. The Shop Superintendent made a study of the number of vehicles added to the city's operations over the past few years.

The Sanitation Superintendent noted the number of new customers on his trash and garbage route and the increase of rubbish hauled from the city each year. The Street Superintendent took a good look at the city's street system and its growth in paving, added streets, street maintenance, street sweeping, etc.

We were also fortunate in having two reports concerning the potential growth of the Texas Panhandle made in 1951 by the Bureau of Reclamation and the Bureau of Business Research of Texas University. We studied these reports very closely.

When we came together to settle the question of proposed size and growth, we found the estimates varied from almost nothing to a sizable growth. The highest estimate was an increase of 500 families a year and 200 acres a year development.

Anybody's Guess

It looked as if anybody's guess was as good as the next fellow's. But after careful consideration of the information we all had, we set our own average at 300 new families a year and 100 acres a year development. With this as our guide, we proceeded to make our estimates for motorized equipment, water wells and water distribution expansion, additions to the sewer treatment plant and collection system, parks, paving, etc.

We found, with the increased use of air conditioners and the building of new residential lawns, our peak water consumption exceeded 400 gallons per capita per day. The average was above 200 gallons per capita per day, which is much higher than the national averages listed in some of the magazines. Our information was used in projecting the needs in the water and sewer departments.

We estimated that a 100-acre subdivision would bring from 20,000 to 25,000 feet of streets into our street system. For a subdivision of that size, we estimated the following water department needs: 650 feet of 10-inch water mains, 3250 feet of 6-inch mains, 5900 feet of 2-inch mains and a minimum of fifteen fire hydrants. To serve the subdivision with sewers, we estimated a need of 2000 feet of 8-inch sewer mains, 6500 feet of 6-inch sewer mains and a minimum of 14 manholes. It would also require about 2500 feet of 12-inch outfall sewer mains.

Such a subdivision would have approximately 480 standard residential lots; 50 percent of the new homes, we estimated, would be constructed in the new subdivisions and 50 percent in older subdivisions not fully developed.

Equipment Inventory

Each Department Head was required to make an inventory of all his equipment costing $250 or more. He was required to find the exact date the city purchased the equipment, make a careful inspection as to its condition and, if possible, estimate the cost of repairs since its purchase.

The natural thing to do was to schedule all replacements in the first year but since this would have been impossible because of funds, we studied the equipment needs carefully in addition to equipment condition. It was after several conferences with Department Heads that we arrived at a distribution over the three-year period for re-

placements. The additional equipment for maintenance did not seem to present the same problem.

The major utility improvements were discussed in several conferences with our consulting engineer who is at present employed on a monthly retainer basis. Our consulting engineer computed the cost of wells, overhead storage, water transmission lines, sewer outfall lines, lift-stations and the like.

On their work sheets, the Department heads indicated the items that were a *must* and the items that could be postponed until the next year. They also divided their requests to show the quarter of the fiscal year that they thought the equipment or improvements would be most needed. All requests, of course, were divided between current funds and bond funds.

On the work sheets also, the department head stated briefly the reason for each request.

In making our study, some members of the City Council were contacted on the subjects on which we felt they had special knowledge. We did not, however, discuss the project with the Council as a body. We felt it would be better to present the Budget as a whole to the Council for their study and criticism

(*Continued on page* 167)

TABLE I—CAPITAL OUTLAY BUDGET FOR THREE YEARS (Selected Departments)

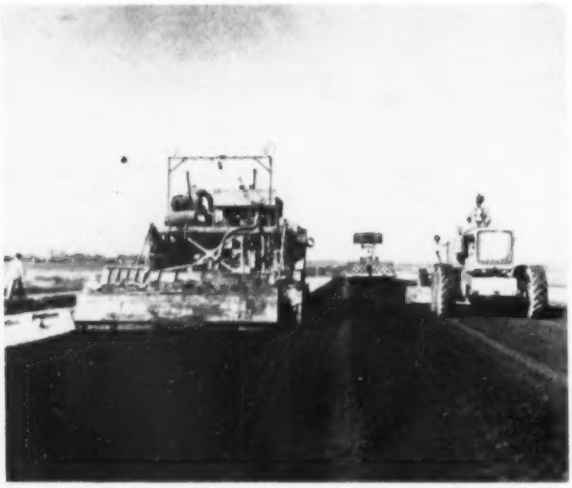
	1953-1954		1954-1955		1955-1956	
	Current Fund	*Bond Fund*	*Current Fund*	*Bond Fund*	*Current Fund*	*Bond Fund*
STREET DEPARTMENT:						
Miscl. Equipment	$ 500		$ 500		$ 500	
Dump Trucks	5,700 (2)		8,700 (3)		8,700 (3)	
Pick-ups, ½ & ¾ ton	1,500		1,700			
Truck, 1½ ton	1,800					
Sweeper & Brooms	1,500			$ 7,000 TW		
Air Compressor	2,100					
Paving Equipment	700*		3,600*			
Maintainers		$ 12,000TW		12,000 TW		$ 12,000TW
Seal Coating		30,000*		30,000		20,000
Street Widening		75,000*				
Storm Sewers		25,000*				
Totals	14,000	142,000	14,500	49,000	9,200	32,000
SANITATION DEPT.:						
Trucks, 2½ tons	6,200 (2)		3,100 (1)			
Trucks, 2 tons					2,400	
Packer Bodies, 16CY	4,500		4,500			
Pick-up, ½ ton			1,500			
Miscl. Equipment			500			
Additional Land	1,500					
Totals	12,200		9,600		2,400	
WATER & SEWER DEPT.:						
Pick-ups, ½ ton	3,000 (2)		3,000 (2)		4,500 (3)	
Pick-ups, ¾ ton	1,700		1,700			
Trucks, 1½ ton	1,900					
Automobile			1,800			
Sewer Cleaning Equip.	1,500					
Portable Pumps	350		200		550	
Air Compressor			3,500*			
Miscl. Equipment	500		600		500	
Office Equip. & Mach.	1,650		2,400		850	
Water Meters	6,500		6,500		6,500	
Mains & Services	5,000		5,000		5,000	
Water Main Extensions		50,000		100,000		200,000
Water Wells		35,000*		35,000		35,000
Booster & Storage, New		150,000*				
No. 2 Booster Addition				15,000		
Elevated Storage						160,000*
Water Rights		25,000*				
Sewer Plant Improvements				100,000		
Sewer Mains, Extensions		15,000		75,000		75,000
Sewer Mains, Replacements		10,000		30,000		20,000
Lift Station, SW of City				10,000*		
Totals	22,100	285,000	24,900	365,000	19,900	490,000

Note: Items marked (*) may be postponed until the next year.
Items marked TW means they should be paid for by Time Warrants.

Methods and Equipment

FOR

SOIL-CEMENT PAVING



● **TRAVELING** mixer of "flat" type in operation. Also shown here are other pieces of equipment, including sheepsfoot roller and motor grader.

● **ROTARY** speed mixers are invaluable adjuncts in thoroughly mixing the components of a soil-cement road. Team procedure is shown here.

● **TRAVELING** mixing machine of the windrow type does the entire job of mixing soil, cement and water in one quick and efficient operation.

● **BULK CEMENT** spreader distributes cement to surface before mixing. Canvas cover on dump truck prevents loss of cement during transit.

THREE factors govern the success of soil cement pavement: (1) An adequate cement content; (2) a proper moisture content; and (3) proper, uniform density.

This holds true whether the pavement is constructed with outmoded plows, discs and cultivators or with modern mixing machines. The objective is the same in all instances: to obtain an intimate mixture of pulverized soil with the proper cement and moisture content, and then to compact this damp mixture to maximum density.

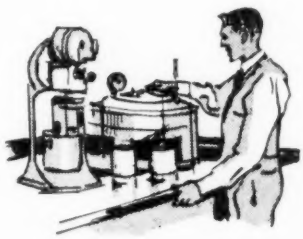
This is attained through nine major steps. The first step involves field analysis and laboratory testing of the soils to determine their suitability for soil-cement construction, the amount of water and cement needed, and the degree of compaction required. The second step is preparation of the site for processing. It consists of placing guide stakes and blading the road or street site to crown and grade. The actual processing of the soil and cement—the physical construction of the pavement—involves seven steps, and as many as four of these may be combined into one by machines commonly in use today. The seven steps are: (1) Scarifying, pulverizing and sometimes prewetting the soil; (2) uniform spreading of portland cement; (3) thorough "dry-mixing" of soil and cement; (4) addition of water and "damp mixing"; (5) thorough compaction of the soil-cement; (6) finishing; and (7) placement of protective covering for curing.

In most instances an eighth step, not actually part of the soil-cement base construction, is carried out. This consists of placement of a bituminous surfacing on the base, and is usually done about a week after construction.

Selecting Soils

About 90 percent of the materials needed to build a soil-cement base are obtained directly from the site, or from a nearby source, in the form of soil. The "soil" of soil-cement includes a wide range of materials besides surface dirt or earth. Existing material in an old granular base or bituminous surfaced road frequently may be utilized. Scoria, caliches, limerocks, shell, slag, cinders, shale, windblown, glacial and beach sands have all been used successfully, to name but a few.

Good gradation from coarse to fine is not needed. But it is desirable that at least 55 percent of the material pass a No. 4 sieve (about $\frac{1}{4}$-in. sq.), since this material when mixed with cement and water forms the bonding "body" which holds larger pieces of soil and aggregate in place. The maximum size of stone or gravel should not exceed 3-in. diameter. Generally, any soil that can be pulverized economically may be used. As soils become more clayey, both pulverizing time and the quantity of cement required usually increase. Where difficulty is encountered and lighter textured soils are available in the near vicinity, it may be more economical to borrow these. They may be used to blanket the existing soil entirely, or may be mixed with this soil.



Laboratory Tests

Three simple laboratory tests are conducted before soil-cement paving. They are: (1) Moisture density tests (ASTM designation D558-44, AASHO designation T-134-45); (2) standard wet-dry test (ASTM designation D559-44, AASHO designation T-134-45); and (3) standard freeze-thaw test (ASTM designation D560-44, AASHO designation T-136-45). These are described in detail in the Portland Cement Association "Soil-Cement Mixtures, Laboratory Handbook". Short-cut procedures have been evolved to determine adequate cement contents for sandy soils, and are available from the same source. They determine the proper quantity of cement to add to the soil, the approximate moisture required and the minimum density to which the mixture should be compacted.

Construction Equipment

Soil-cement pavement may be constructed with three types of mixing equipment. They are: (1) Traveling mixing machines of the windrow or "flat" type; (2) mixed-in-place equipment, consisting of rotary speed mixers, or cultivators, discs, and plows; and (3) stationary mixing plants of the batch or continuous flow type.

Windrow-type traveling mixing machines, as the name indicates, combine soil and cement placed in windrows ahead of the machine into a dry mix. They then combine this mix with water and deposit it behind the machine in windrows.

The flat type of traveling mixing machine works with the soil in place and does not require windrowing. After the grader has bladed the site to crown and grade, and cement has been spread, the machine moves over the area. It scarifies, pulverizes and mixes the soil with cement, then with water, and deposits the damp mix in a flat path behind the machine. Stationary mixing plants are used only occasionally on large jobs where borrow soils are necessary.

Mixed-in-place construction has been greatly facilitated by the growing and accepted use of rotary speed mixers for pulverizing and mixing. Plows, discs and cultivators, commonly in use half a dozen years ago, are rarely used today, and then only on small jobs.

Regardless of the type of mixing equipment used, the same general procedures are followed—although during construction two or more operations may be combined or may be progressing at the same time. The seven construction steps given previously and the discussion that follows serve to point out the steps in soil-cement construction, irrespectve of the mixing equipment used.

Scarifying and Pulverizing

The first actual step of construction involves the scarification, pulverization and pre-wetting of the soil to be processed. Generally, soils as used in soil-cement construction are friable and require little scarification and little or no pulverization. Scarifying is done usually with the scarifier attachment on the motor grader and pulverizing with rotary speed mixers or preparizers. At this stage of construction only preliminary pulverization is required, since additional pulverization will be obtained during mixing operations. With some soils and equipment, initial pulverizing is not needed.

Pre-wetting of dry soil on the day before processing has become common practice among many contractors. It facilitates pulverization and mixing, and reduces the overall time required during processing, since a goodly proportion of the required water already has been added. After scarifying, pulverizing

and pre-wetting, the loose moist soil is leveled to approximate crown and grade with the motor grader.

Spreading Cement and Dry Mixing

Mechanical cement spreaders are in common use today. Where they are used, control is on the basis of a square yard unit of area. Bulk cement is loaded into a dump truck, to which is hitched a spreader of one of several types. As the truck moves forward, the cement flows from its tilted body into the spreader. Control over the operation is provided by adjustable strike-off plates which regulate the quantity spread on the soil.

Where hand spreading is used, a good method of assuring proper spotting of bags is to use two chains with flags or markers attached at proper intervals. The bags are opened in line with the markers and the cement dumped so that it forms a uniform transverse windrow across the scarified soil. A spike-tooth harrow or nail drag is then used to spread the cement uniformly. Two round trips or more are usually necessary.

As cement spreading equipment nears the end of its run, dry mixing is begun. Very thorough mixing is not necessary, since the main objective is merely to distribute the cement throughout the soil so that cement balls will not be formed upon application of water. Towards the end of dry mixing, the depth of treatment and uniformity of mix are checked by digging a transverse ditch. Representative dry mix samples are also taken to determine the moisture content, and through field laboratory tests the amount of water needed to bring the mixture to optimum moisture or slightly above. Water requirements for the damp mix process are determined in this way.

Damp Mixing and Compacting

Water is added to the dry mix from pressure distributors in as large increments as the soil and equipment will permit—generally about a gallon per sq. yd. per trip. Each increment of water is mixed with the soil and cement before the next is begun. Distribution is continued at a fast rate until approximately three-fourths of estimated requirements have been met, at which time the engineer takes representative samples for moisture and density tests. During these field tests, control of water application is largely by "feel" of the mixture. At optimum moisture, the average mixture is just damp enough to form tightly when packed into a cast or cylinder in the hands. It is not muddy or mushy and leaves the hands only moist. The engineer controls water application until he believes that the area is ready to pack. Moisture tests will substantiate the actual time when water distribution should cease. After the last increment of water has been added, mixing is continued until a thorough mixture of soil, cement and water is obtained.

At this point, the sheepsfoot roller begins compaction at the edges of the roadbed. During compaction, additional water may be added from time to time to keep the moisture content of the mixture at optimum or slightly in excess. Where a sheepsfoot roller cannot operate because of absence of fines in the soil, a tractor-drawn pneumatic-tired roller is used. When the print of the sheepsfoot rollers is about 2 in. deep from the surface, the motor grader is brought in to shape the area and obtain a uniform mulch at the surface. Final shaping begins when about an inch of loose mulch remains.

At this point, the sheepsfoot roller is removed and the motor grader takes over. A small quantity of water is usually required to replenish evaporation losses at the top and to produce a tightly knit surface. Compaction planes made by the rollers and motor grader are removed with a nail drag or a lightly weighted finger weeder or spike-tooth harrow, and finishing operations start.

Surface finishing and compaction is done by pneumatic-tired rolling, blading, broom dragging, and smooth wheel rolling. Light watering and pneumatic-tired rolling is the last step in this process. A density check of a section is made to check compaction achieved, either during final rolling or on the morning following construction.

Currently, curing is being done largely with bituminous materials because they act as a prime coat for the bituminous wearing course that is later applied, as well as a curing agent. Where traffic must use the base immediately, light sanding will prevent pickup.

For roads and streets, a bituminous surface treatment less than an inch thick is common practice. For airport runways, a plant mix bituminous surface about $1\frac{1}{2}$-in. thick is used where considerable traffic is anticipated.

(Continued from page 77)

Rochester Snow Removal

An important factor in the promotion of satisfactory snow plowing and removal operations is that of communications. The division employs the regular Rochester Telephone Company services, plus the Police Bureau street telephones and its radio communication system, and the Rochester Transit Corporation street telephones. In addition, the department has now completed the installation of its own two-way radio system, with two of three transmitting base stations located at the Portland Avenue Yard and the Dewey Avenue Garage. All headquarters staff autos and service trucks have two-way mobile radio units installed. It is expected that this addition to the existing system of departmental communication will prove very valuable during the forthcoming winter seasons.

The cost of snow plowing and removal and icy street protection is met each year by a special assessment authorized previous to each winter season by ordinance of the City Council. In recent years, the limit per season has been set at $750,000 for roadway snow plowing and removal and icy street protection, and $150,000 for sidewalk snow plowing. For a normal winter, the total cost will not exceed $700,000. It is assessed to property owners at the end of the season on a front footage basis. Hired truck plows are paid on the basis of miles per trip in accordance with scheduled routes. Contracts for the plowing of sidewalks are awarded at the beginning of each season to the lowest responsible bidder for each district. The contractor must prove that he has adequate personnel and equipment before an award will be made, and he is paid a base price for the season plus his bid price per trip.

• • •

Driver License Examinations for Elderly Persons

According to the National Driver Examiner, more than 900 of the 3,292 Virginians 65 yr. of age and older who took the complete examination for oldsters renewing their driver's license, failed on the first try because of deterioration of vision. The new law allows an oldster to try as many times as he wishes to pass the examination.

PRE-FABRICATED MEDIA FOR BIOLOGICAL TRICKLING FILTERS

H. C. LEIBEE,
Consulting Engineer,
Minneapolis, Minnesota

AERO - Block, a prefabricated vitrified tile media, is probably the only prefabricated media designed and commercially used for trickling filter media. It has been in use for about eighteen years. It was originally developed and patented by A. A. Page, but following his death, his estate failed to permit its manufacture for many years outside this immediate territory. Today there are a number of companies that will supply this media including the Red Wing Sewer Pipe Corporation, Red Wing, Minnesota; the Dickey Clay Manufacturing Company, Kansas City, Mo.; and the Washington Brick and Lime Co., Spokane, Washington.

This media is designed to meet the following conditions:

First—To supply the maximum amount of *effective* surface available for the growth of microbial organisms. The actual effective surface of tile media approximates 25 sq. ft. for each cubic foot of volume, compared to an actual surface for rock media of approximately 12 sq. ft. for each cubic foot, with only a very small part of this surface *effective*.

Second—To be self-cleaning so as to prevent the accumulation of sludge pockets where anaerobic digestion can occur with consequent return of part of the organic material to solution.

Third—To maintain filter media walls not closer together than one inch, because the filter flora can exceed one-quarter inch in thickness.

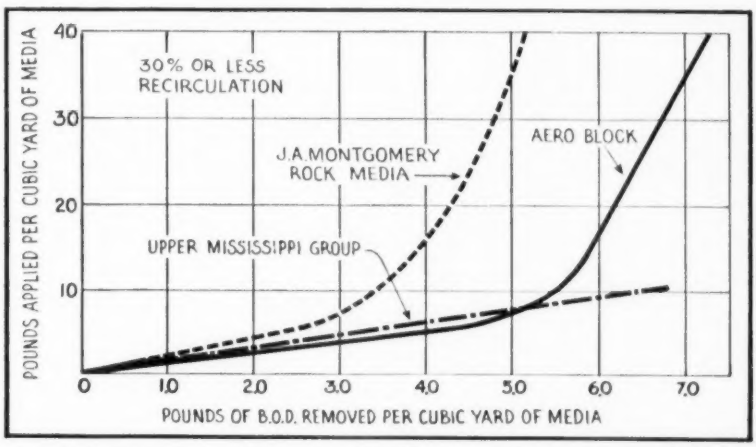
Fourth—To maintain the film thickness of the liquid which is spread over the top of the media by the distributor uniformly from top to bottom of the filter.

Fifth—To provide a construction so that adequate air is supplied to the flora to maintain it in a completely aerobic condition.

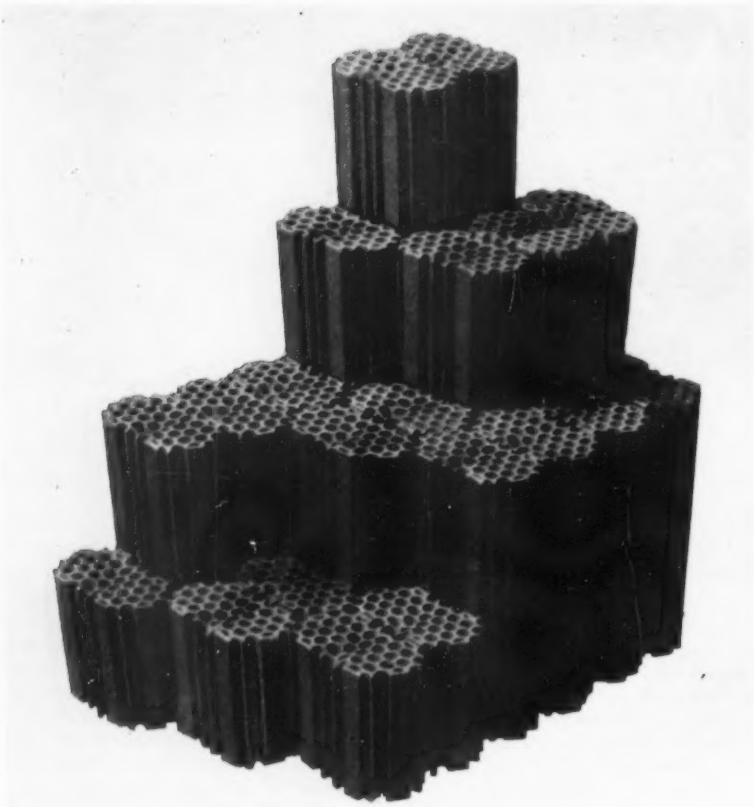
Filter flora life is a composite of protozoa, worms, fungi and bacteria of which the bacteria are probably the predominant form of microorganic life. Dr. Henrici, the late head of the Department of Bacteriology at the University of Minnesota, in his study of stalk bacteria, found a logical explanation of the physical functioning of the filter flora. The active microbial life is aerobic, the bacteria being attached to the filter media by "stalks", with the head of the stalk being the active part of the stalk bacteria. The growth of these bacteria in large numbers creates a dense microbial "forest" that eventually prevents air from reaching the media surface and produces a condition wherein anaerobic liquifaction can dissolve the attaching element of the bacteria and cause the flora to slough. The sloughing is evidenced by the typical large particles visible in the filter effluent during unloading periods.

In the case of rock media, sewage applied at the top of the filter tends to draw together and create a few large channels, thus eliminating a large volume of the bed from use. The "effective" surface of a rock media filter must exclude that part of the rock media where the surfaces are less than one-half inch apart; the underside of the rock particles; that part of the rock surface where the velocity of sewage flow is so low as to prevent scouring and release of filter slough; and that part of the media where channeling prevents the sewage from reaching the media. Rock media is used primarily because of cost. The most desirable rock would be perfectly round rocks of uniform diameter.

It is, of course, impractical to get rock of that kind. The more customary rock media is crushed rock. Care must be taken that there is not an excessive number of flat pieces which must be removed by



● **CAPACITY of rock and tile media for BOD removal. Data are in pounds of BOD removed per cubic yard of media, based on reports from three sources.**



● **TILE MEDIA is perforated with a maximum number of 1-inch vertical holes.**

hand. Commercial rock media is rarely of the right size and screening by hand at the plant site is a normal requirement if satisfactory sizing is to be obtained. Rock media will provide between 9 and 12 sq. ft. of surface per cubic foot of media with 25% to 50% voids.

Manufacturing Tile Media

The original conception of the use of vitrified salt glazed clay, as a substitute for rock, was to make 2-inch diameter round balls. Because of the extremely high labor cost of making the balls, it was quickly realized that any commercially workable prefabricated media must be based upon the extrusion process. The die was prepared and eventually developed into the unit used today. The clay is de-aired and then forced through the die under heavy pressure, cut in the desired length of twelve inches, dried and then kiln burned.

The physical structure of the filter resembles that of a huge swiss cheese, consisting of one-inch diameter round holes extending vertically from top to bottom of the filter, separated by ¼-inch walls. A recent development has been an improved block that locks itself to the block below and maintains the vertical alinement of the holes without the use of dowels. This adds 2% to the surface area of each cubic foot of media. The blocks are set on tile supports placed on curbs constructed on the filter floor and the media is built up to the desired depth of the completed filter.

The use of one-inch diameter holes provides certain basic requirements that must be met. It is obvious that the more customary low capacity distributor might flood the holes and produce a low efficiency. The distribution must be of the rain-drop type, as used with the Aero-filter, with the drops contacting the walls of the vertical holes at an angle. The vertical holes prevent channeling, maintain the same film thickness from top to bottom of the filter and produce a condition approaching the maximum amount of "effective" surface for microbial growth. The vertical walls, with a maintained thin film of liquid, produces the best areration condition; the best scouring condition for removal of sloughed flora; the elimination of sludge pockets where anaerobic digestion can occur with consequent odor; a sufficient gap between surfaces to prevent ponding; a uniform media and a permanent material.

Performance and Loading

The standards of the various states, with the exception of the Upper Mississippi Group, provide for maximum loadings of 1.5 to 2.0 pounds of BOD per cubic yard of rock media. The manufacturers of Aero-filter equipment recommend maximum loadings of 2.0 pounds of BOD per cubic yard of rock media for high capacity filters. It is customary to design tile media filters on the basis of 3.0 to 3.33 pounds of BOD per cubic yard of media. This is in accordance with the design data set up in the Upper Mississippi River report. At the time of the conclusion of the original research work on tile media, Dr. H. O. Halvorson who acted as advisor to Mr. Page, set up a maximum design loading of 1.0 pound of BOD per square foot of filter surface (4.5 lbs. of BOD per cubic yard) for tile media 6 ft. deep.

Tile media is designed to treat strong wastes. The percent of removal will remain constant up to a ppm BOD of 550; the permissible high loadings per cubic yard of media will result in a material reduction in total plant cost; the media is ideal for anaerobic wastes or wastes having a high suspended or settleable solid content. Table I shows records of operation at several plants using tile media.

TABLE I.—Operation Records for Tile Media Plants.

Location	*No. Tests*	*Test by*	*Recirc.*	*Removal %*
River Falls, Wisc.	Daily for 1 yr.	Halverson	None	86.8
Owatonna, Minn.	16 in 1946	City	None	85.4
Detroit Lakes, Minn.	3 in 1944	U.S.P.H.S.	30%	87.5
Ladysmith, Wisc.	1 in 1950	St. of Wis.	30%	84.9
Clear Lake, Wisc.	1 in 1950	St. of Wis.	4 passes	97.4
Kenyon, Minn.	2 in 1951	St. of Minn.	2 passes	83.5

WHAT YOU SHOULD KNOW ABOUT SOIL ENGINEERING

by LEO J. RITTER, JR.

FINAL INSTALLMENT

This section covers practical applications in field identification, soils surveys and construction principles.

Field Identification

CLOSELY related to the routine testing procedures and soil classification systems, which were described in the preceding articles, is the matter of field identification of soils. It is particularly important that engineers who are engaged in field sampling operations are familiar with qualitative procedures for identifying the principal soil types; carefully written descriptions and accurate identifications of soils encountered in the field are of great value to all concerned. The only really adequate way to learn field identification is by constant experiment and careful observation under the direction of an experienced soil engineer. However, certain basic principles are of consequence.

A given soil may be placed in one of the two large categories—coarse-grained or fine-grained soil — by visual inspection in the majority of cases. The presence of gravel is readily detected, since the individual particles are easily discernible by the naked eye. The terms coarse gravel and fine gravel are sometimes employed to delineate further this class of material. Many organizations stress the importance of noting the maximum size of gravel particles. Sands are generally readily identified, both by visual inspection and by their characteristic "gritty" feeling between the fingers. Terms "coarse" (rock salt), "medium" (table salt), and "fine" (powdered sugar) sand are frequently employed in field identification; size limits applicable to these different categories have been given previously. It is sometimes quite difficult to distinguish between a fine sand and a silt; the principle of sedimentation may be employed effectively to differentiate them. If a soil is thoroughly dispersed in water and then allowed to settle, the water to a depth of about 2¾ inches from the surface will become clear in 30 seconds or less if the material is all sand and the water to a depth of about 3¼ inches will become clear in one hour if the material is mainly silt.

Factors which are of principal importance in describing and identifying the coarse soils are grain size, grain shape and gradation. Grain size limits have been given previously as have factors relative to grain shape. Terms which are frequently applied to indicate gradation are uniform (essentially one size), graded and well-graded. Where the material is to serve as a foundation in its natural state, the compactness (density) of a cohesionless soil may be very important; terms such as loose, firm, dense and very dense are frequently utilized. It should be noted that some sands and gravels may contain organic material; unless the amount of organic material is high its presence generally is of little practical significance. Color of these soils is also usually not important, although color may be a valuable aid in identification. In some cases it may be important to note the principal mineral constituents of a coarse-grained soil, as quartz, mica, shell, coral, granite, etc.

One of the principal field tests which is used in identifying fine-grained soils is the "shaking" or "dilatancy" test. In this procedure a moist lump of soil is alternately shaken in the palm of the hand and then squeezed between the fingers. A fine-grained soil which is non-plastic will become somewhat "livery" in appearance and will show free water on the surface. When the soil is squeezed the water

will disappear from the surface which will become dull in appearance. The thing to look for is the speed with which the lump of soil changes its consistency and the water appears or disappears. The speed of the reaction is usually classed as "rapid", "slow" or "no reaction". A rapid reaction to the shaking test is typical of uniform fine sands or inorganic, non-plastic silts. Organic and slightly plastic silts show a slow reaction to the test; even a small amount of plastic clay will appreciably slow the reaction to the shaking test. Clays are typified by a very slow, or no reaction to the test. A high degree of stickiness and a very smooth smear are indicative of higher plasticity.

Useful information may also be gained by performing the plastic limit test roughly in the field and judging the strength of the thread which is formed when the moisture content of the soil is at or near the plastic limit. Highly plastic clays are characterized by stiff and tough threads. A medium stiff thread indicates a clay of moderate to low plasticity, while the inorganic silts and highly organic fine-grained soils in general show weak threads.

The dry strength of the material as judged by crushing in the fingers also is of value as an indicator of its nature. The non-plastic soils invariably have practically no dry strength; soils of low plasticity, including very silty inorganic clays, have low dry strength. Medium dry strength—that is, moderately difficult to crush between the fingers—is typical of most clays. Very high dry strength is shown only by very highly plastic clays. When the dried lumps are placed in water those which are non-plastic or moderately plastic slake very rapidly. Highly plastic soils slake very slowly, frequently requiring several hours to break down to the extent that a silt will in a few minutes.

In the field identification of fine grained materials, color may be a valuable aid, especially when coupled with experience in a given area. Clean, bright colors are generally associated with inorganic soils, while dark shades of gray and brown, and black, are typical of organic soils. Highly organic soils also usually have a distinctive odor, particularly when wet.

Again from the standpoint of its behavior as a foundation, the consistency of a fine-grained soil may be extremely important. Thus, terms such as very soft, soft, firm, stiff or hard are used. Application of the proper descriptive term may be judged by comparative resistance to squeezing of an undisturbed sample between the fingers. Other consistency characteristics, such as brittle, elastic, spongy, sticky, friable (crumbles readily) or sensitive (loses strength when remolded) may be important. Facts relative to structure may also be of consequence in some cases and can be detected only by careful observation.

The desirability of a concise, carefully written description of a soil encountered in the field is readily apparent. In writing the description the soil is designated as one of the major soil types, i.e. gravel, sand, silt or clay, depending on which is the predominating group; less important constituents are used as modifiers, with the least important first. Thus a soil which has 60% sand, 28% silt, and 12% clay might be called a clayey, silty, sand. Other methods are used. For example, the term "trace" is sometimes used to indicate from 1 to 10% of a certain size; "some" is used when the percentage is between 10 and 20%; an adjective, e.g. "sandy" or "silty" is used if between 20 and, say 35%; "and" is used, as "sand and gravel", if between 35 and 50%. In this system the soil above would be a silty sand, with some clay. As many of the important factors as possible are included in the description, as indicated in the following examples. Abbreviations or "shorthand" may be used to facilitate keeping of the field record and in showing the information on the plans.

1. Loose, yellow to light brown, uniform, rounded fine sand (A-3; SP)

2. Firm, well-graded, angular silty, sandy gravel, maximum size ½ inch. Binder soil of low to medium plasticity and low dry strength. (A-1-b or A-2-4); (GW—GM)

3. Dark green, homogenous, stiff, brittle silty clay; very soft and sticky when remodeled. (A-4 or A-7-5; CL).

4. Yellow to brown, homogenous, soft to moderately stiff, highly plastic clay. (A-7-6; CH)

5. Dark brown to black, woody, fibrous, highly organic sandy silt (A-8; OL or Pt).

Soil Surveys for Highways and Airports

The conventional-type soil surveys which are required in connection with highway and airport location, design and construction are usually carried out by securing disturbed soil samples to relatively shallow depths over a limited area. An investigation of this type may be made in connection with the location or relocation of a highway or airport, or the examination of possible sources of borrow material. It may also be used for various types of special purpose studies, such as those required to determine the effect of soil type and condition upon the behavior of an existing pavement. Information which is desired in a survey of this type usually includes that relative to the general nature and extent (both in a horizontal or "areal" sense and vertically) of the soil layers which exist within the area involved, the location of the ground water table, and the securing of representative samples for laboratory analysis and classification.

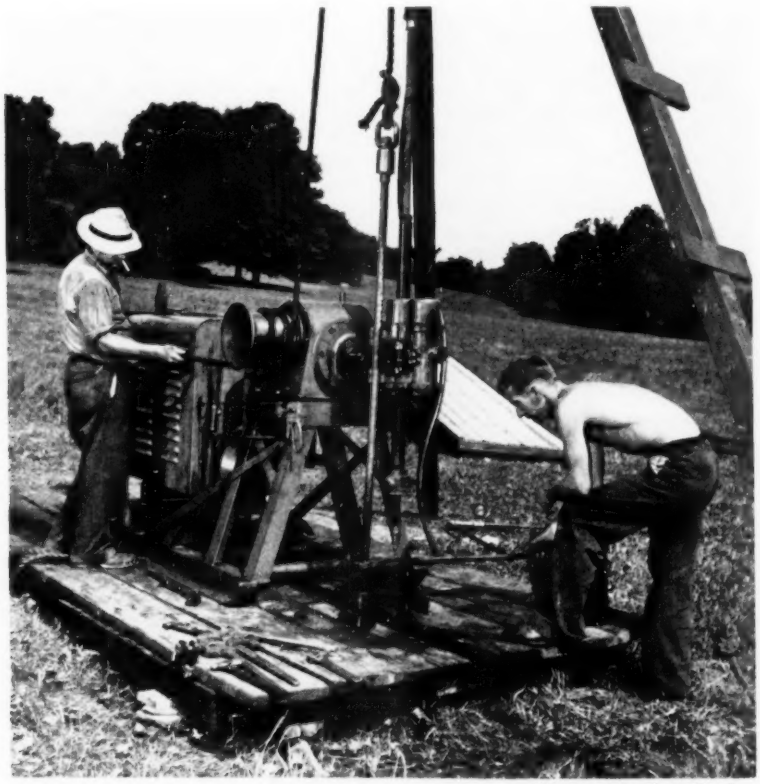
This type of soil survey may also serve as a preliminary survey which will provide some of the information needed to plan the more elaborate exploration program which may be required at the site of a bridge pier, an airport building, a large embankment over a very weak soil, or for the structural design of a pavement. These are essentially foundation problems and may require the securing of relatively undisturbed samples to comparatively great depths so that an accurate evaluation may be made of the shearing strength and consolidation characteristics of the soils encountered at the site.

A number of the state highway departments use this general approach in making subgrade soil surveys. Other groups use somewhat different approaches in which extensive use is made of agricultural soil maps, aerial photographs, and so on; these agencies also take some disturbed soil samples, although the number of samples may be sharply reduced. Samples are generally secured by means of a soil auger, which may be hand operated or mechanically driven. Samples are from 2 to 4 inches in diameter and, though completely disturbed, they are generally suitable for moisture content determinations and for classification. The economical limit of depth of auger borings of this sort is about 20 feet, and it is obviously very difficult to obtain samples of some soils; for example, clean sands below the water table.

When the soil survey is being made as a part of the preliminary location survey for a new highway, average practice calls for borings to be made at intervals of 500 feet or so along the proposed center line; other borings may be made along the sides of the proposed road, as required. If soil conditions are not uniform, many more borings may be made in order to delineate important soil layers with some degree of accuracy. In general, borings are made to a depth of 3 to 5 feet below the grade line. In embankment sections visual examination of the surface soils may be regarded as sufficient, although this is frequently not enough if the embankment is to be fairly high.

In boring, a continuous record is kept of the soils encountered from the surface to the bottom of the hole; each soil is accurately described and its depth and thickness noted. Depth to the ground-water table is also carefully recorded. Position of the water table may be determined by allowing the auger hole to remain open over night and then measuring the depth from the surface of the ground to the free water surface. Other information of significance, such as depth to rock and its character, and seepage flows of water are also recorded.

The soil samples are put into bags, cartons or jars, properly and fully labeled, and sent to the laboratory for further identification and classification. On the basis of the field boring records and the results of the laboratory testing, a "soil profile" may be prepared and made a part of the plans. Such a profile is obviously of great value to the designer and to the contractor who must translate the plans into reality. The plan may, for example, show the presence of soils of very low permeability which will be difficult to drain and may require special drainage provisions; it may show the existence of highly organic soils, like peat and muck, which will require special handling or which must be removed. The nature and extent of rock is also extremely important in some cases, affecting both design and construction procedures and costs. Reliable soil information serves to reduce construction costs, since the element of uncertainty regarding possible soil conditions is largely removed from the bidder's mind; this may result in a direct decrease in bid prices, particularly for earthwork operations.



Courtesy Acker Drill Co., Inc.

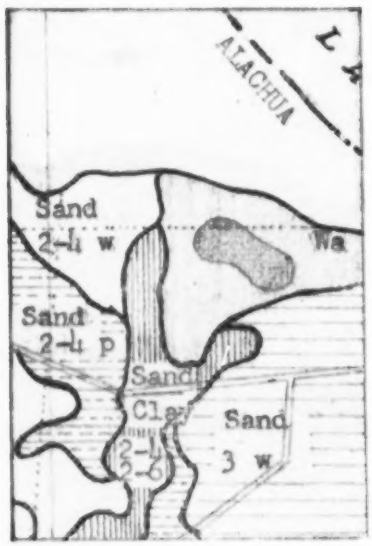
● **SOIL SAMPLING drill of a type used for taking specimens of subsurface strata.**

Many organizations do not rely entirely upon this sort of approach in order to gather desired soil information. A number of them simplify and reduce the amount of detailed soil sampling needed by the judicious use of other sources of information. Principal sources of information which are thus used include geological maps and reports, agricultural soil survey maps, aerial photographs, and topographic maps. A few organizations build their entire approach to the problem upon utilization of one or more of the types of information listed; only enough sampling is done to supply engineering soil information not otherwise available.

For example, a few state highway departments, like those of Michigan, North Carolina, and Missouri, use agricultural soil information with little modification. Maps which are prepared for new projects use agricultural soil terminology. The experience which these groups have built up over many years in using this approach is what makes it valuable. Seismic and electrical resistivity methods, which are used extensively in such applications as prospecting for oil, are also being used for shallow soil exploration by some agencies.

Modern techniques which are being used to obtain adequate soil information seem to emphasize the use of all the available information about a given area in an effort to minimize the amount of detailed field and laboratory work necessary for a given project. The importance of good soil information in highway and airport work cannot be overemphasized. Adequate information of this sort will result in better and more economical design, and in lower construction costs.

In Fig. 18 are shown (a) an aerial photograph, (b) the agricultural soil map of the same area, and (c) the corresponding engineering soil map. This is a section of Alachua County, Florida; items shown in the figure were furnished by W. H. Zimpfer of the University of Florida. The engineering soil map was prepared after an extensive research program involving the correlation of existing sources of information, some field sampling and a considerable amount of laboratory testing. Areas in the engineering soil map are clearly delineated; symbols that are used are related to the Revised Public Roads system. For example in the area marked "Sand—3w" the



● FIG. 18 (see page 97) shows method of using existing soil data

surface soil is an A--3; the *w* stands for "well-drained". Other factors are also involved in the assignment of this designation to this soil area; among them are topography and slope, depth to the water table and ability to support a pavement. The important thing is that wherever a soil area which is marked "Sand—3w" appears on an engineering soil map of Alachua County (or of the state, for that matter) design and construction problems associated with it will also appear. Obviously, the existense of a map like this one is a great aid when a highway is to be located across the mapped area.

None of the techniques which has been described will provide samples suitable for the determination of the so-called structural properties of undisturbed soils. Other procedures must be utilized to secure samples which permit the determination of consolidation characteristics, shearing resistance, permeability and so forth, particularly where fine-grained soils are involved. Samples which are essentially undisturbed may be obtained in a number of different ways. In general, samples are secured by digging test pits or by borings. An undisturbed block of soil for the sample may be cut from the pit wall or floor. Obviously this method is limited to very shallow depths. When samples are desired from greater depths borings are used. Procedures vary, but in general a hole is advanced to the desired depth by rotary drilling or washing methods, the hole cleaned out, and a sample tube or "sampler" forced into the soil. Samples may then be removed from the sample tube and subjected to laboratory testing. Care is required but good samples are usually not too difficult to obtain.

Compacting Soils

From a practical viewpoint, the proper compaction of the soil in a fill which is to support a highway or an airport runway is very important. Proper compaction will increase the strength of the soil and minimize its compressibility, thus largely eliminating damage which may result from uneven settlement because of consolidation of the fill material itself. Compaction may reduce the tendency of some soils to absorb water after construction is complete. Advantages also accrue from the careful compaction of subgrades in cut sections, bases and secondary road surfaces made from soil.

Recognition of the advantages of compaction is seen in the widespread construction of highway fills by rolling. In brief, the fill is formed in thin layers, the soil is maintained at a desired moisture content, and each layer is compacted—frequently by using sheepsfoot rollers—until the desired density (unit weight) is obtained. An embankment formed in this fashion is called a "rolled-earth fill."

Basic theory of compaction depends upon the fact that nearly all soils show a similar relationship between moisture content and dry unit weight when subjected to dynamic compaction. More specifically, practically every soil has an *optimum moisture content* at which the soil reaches *maximum density* under a given compactive effort. In further explanation, dynamic compaction here conveys the idea of a moving weight which is allowed to strike the soil mass; it is contrasted with static compaction in which a static load may be applied to compress a soil. By compactive effort is meant the amount of energy which is applied to the soil during the compaction process; it may be expressed in foot-pounds per cubic foot of soil. Modern practice stems from the work of R. R. Proctor, who first published information concerning basic moisture-density relationships in 1933.

The meaning of the terms "maximum density" and "optimum moisture (content)" is clearly shown in Fig. 19 The plot shown is a typical moisture-density relationship and was obtained in the laboratory. In the field, as will be explained in more detail later, an attempt is usually made to maintain the soil at or near optimum and roll it until the maximum density, or a specified minimum percentage thereof, is achieved. The curve of Fig. 19 is valid for a given soil for *one compactive effort only*, since both the optimum moisture and maximum density vary with the compactive effort. Because of this fact, care must be taken to make sure that the compactive effort used in the laboratory and that applied in the field are the same, or at least bear a known relationship to one another, if the laboratory curve is to be used to control the field rolling process.

In the laboratory two standard compaction procedures are widely used by highway and airport engineers. Each of these involves a standard amount of energy per unit of volume of the soil mass. The first of these is the "Standard Proctor" or

"Standard AASHO" procedure. In this, the soil is compacted in a standard mold which is four inches in diameter and has a volume of 1/30 cubic foot. The soil is placed in three layers of approximately equal thickness and each layer is subjected to 25 blows from a hammer (rammer), which has a striking face two inches in diameter and a weight of 5½ pounds, falling freely through a distance of 12 inches. The compactive effort involved in this procedure is 12,400 ft.-lbs. per cubic foot of soil. This procedure is still widely used in controlling the compaction of highway fills, although there has been some tendency toward the use of greater compactive efforts in recent years with the advent of heavier rolling equipment. When this compactive effort is used, optimum moisture is approximately 3% less than the plastic limit for some plastic soils.

The second commonly used compactive effort is that involved in the "Modified AASHO" compaction procedure; it represents a much greater amount of energy than that of the "standard" effort. If the same mold is used as previously described, the soil is placed in five equal layers, each of which is subjected to 25 blows from a hammer which has a striking face 2 inches in diameter and weighs 10 pounds, falling freely through a distance of 18 inches. The amount of energy is 56,200 ft.-lb. per cubic foot of soil. This procedure has been used in controlling the compaction of airport subgrades, since the additional expense involved in using heavier equipment and attaining greater density in the field is justified by the necessity of attaining greater shearing strengths in order to support the extremely heavy wheel loads of modern aircraft.

The procedure may be carried out by hand or by the use of any one of several automatic compactors. Compactive efforts which are different from those which have been described may also be used.

Laboratory Procedure

In the laboratory procedure, the curve of Fig. 19 is obtained by compaction of a series of samples of the same soil by exactly the same procedure, but at different moisture contents. The series is begun with the soil in a damp condition, somewhat below the probable optimum moisture content. The soil is compacted, the wet unit weight determined and a sample taken for the determination of moisture content. A second sample with an increased moisture content is then compacted; the process is repeated with additional samples until the wet unit weight decreases or the soil becomes too wet by visual inspection. After the moisture contents have been determined, the dry unit weight corresponding to each trial may be computed and the plot of Fig. 19 prepared. Without giving a detailed explanation, the behavior of the soil at different moisture contents may be visualized as follows. When the soil is comparatively dry, there is not enough water present (or the adsorbed water around the particles is too viscous) to "lubricate" the particles and allow them to "flow" or move closer together under the blows of the hammer. As the water content is increased the particles move closer together, thus resulting in an increase in density. At the optimum moisture content a limiting degree of saturation has been reached; the soil is not completely saturated, since air is present in the voids and around the soil particles. If additional water is added the amount of air voids will not be appreciably reduced. The added water merely tends to overfill the voids and force the solid particles apart, resulting in a decrease in dry density.

Two other aspects of the theory of compaction are of interest. Referring again to Fig. 19, note the line which is marked "zero air voids curve". Each point on this curve represents the dry density of a completely saturated soil of the same specific gravity as that used in the laboratory compaction process and of known moisture content. In other words, S = 100% for these points and the percentage of air voids is equal to zero. This is a theoretical curve which is impossible of practical attainment by compaction alone. Points on the zero air voids curve may be calculated from the following relationship:

$$\text{Dry Unit Weight} = \frac{\gamma_w \, G}{\frac{(100 + WG)}{100}}$$

Where γ_w = unit weight of water, 62.4 lbs. per cu. ft.

G = specific gravity of solids

W = moisture content, in percent

Although densities represented by the zero air voids curve cannot be attained by practical methods, still it provides useful information. For example, notice that beyond optimum the actual curve closely parallels the theoretical limit, but is beneath it. This indicates that the percentage of air voids is essentially constant beyond optimum moisture, since the distance between the two curves is roughly indicative of the amount of air voids present. Note also in Fig. 19 that the same density was secured at two different moisture contents, one less than optimum (on the "dry side") and the other above optimum (on the "wet side"). However, the amount of air voids contained in the soil at these two moisture contents is quite dif-

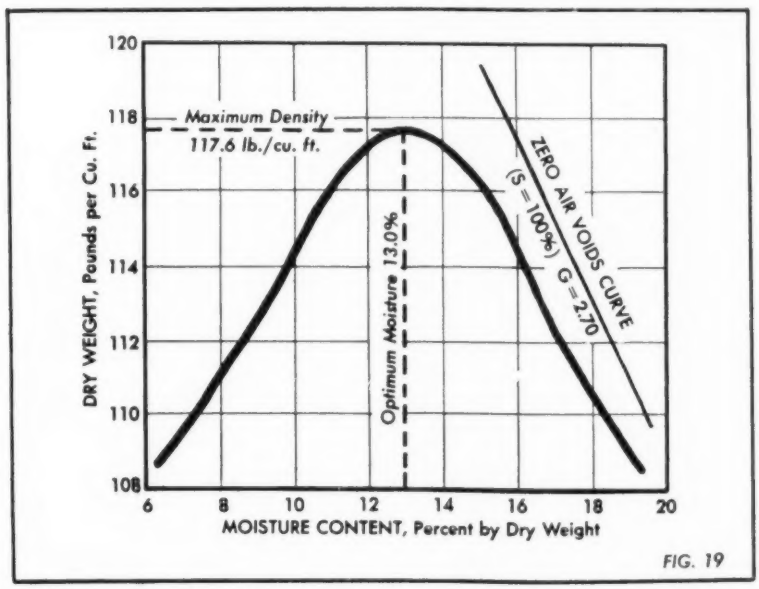


FIG. 19

● **MAXIMUM density-optimum moisture content relation curve for a typical soil.**

ferent. There is a much larger proportion of air voids on the dry side than on the wet side, even though the dry density is the same. The physical properties of the soil may also be somewhat different at the two moisture contents. In certain field situations it is best to compact on the dry side; in others, the wet side may be better. In general, it may be best to compact slightly on the wet side in situations in which the soil will be exposed to water after construction is complete. In such situations the air in the voids may eventually be replaced by water and the resultant swell minimized by compaction on the wet side.

Fig. 20 illustrates another fact of consequence: that both the optimum moisture and maximum density vary with the compactive effort. In general, the optimum moisture decreases and the maximum density increases with an increase in compactive effort, as shown by the figure. Thus, these quantities are not unique properties of a given soil, but are a function of the method of compaction.

Soil taken from cut sections is normally used in forming highway fills. If sufficient material is not available it is taken from nearby borrow sources. On large and important work, the compaction characteristics, other physical properties and comparative costs of available soils should be carefully studied in order to insure an adequate and economical design.

Field methods which are effective in compaction depend upon the type of soil involved. For cohesionless soils, effective compaction may be achieved by the use of pneumatic rollers, tampers and vibrators of various sorts, and crawler tractors. Sheepsfoot rollers are not generally effective in this type of soil. Slightly cohesive soils may be compacted by tampers, pneumatic-tired rollers, and light sheepsfoot rollers; care must be taken to avoid high pressures which will produce shear failure and loose soil. Cohesive soils may be compacted by some tampers and heavy sheepsfoot rollers. Extremely heavy pneumatic-tired rollers and sheepsfoot rollers have been used on airport construction jobs.

As previously indicated, rolled-earth fills are built up in thin uniform layers with each layer being tamped or rolled to the desired density. In ordinary highway work spreading is done by the use of tractor-drawn rubber-tired scraper units. The thickness of the layer

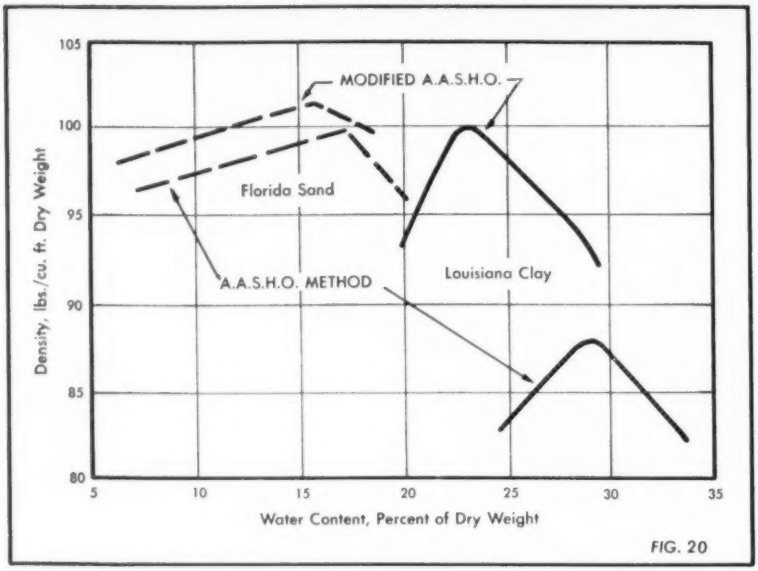


FIG. 20

● **OPTIMUM moisture and maximum density may vary according to compactive effort. In general, optimum moisture decreases as compactive effort is increased.**

varies somewhat, depending on the soil, the equipment to be used, and the experience of the organization concerned. Layers should be quite thin, perhaps from 1 to 3 inches, for some kinds of tamping units; from 3 to 4 inches if crawler tractors or ordinary pneumatic-tired rollers are used; and 6 to 8 inches for the use of ordinary sheepsfoot rollers. Layers may be thicker, up to 12 inches or so, when heavier units are used. The amount of compactive effort exerted on the soil is a function of the thickness of the layer, the pressure which is exerted by the roller, and the number of trips (passes) of the roller.

Moisture content of the soil is obviously important, since optimum compaction is achieved when optimum moisture is maintained. When the soil is at or near this condition a specified density can be obtained with the smallest compactive effort. The laboratory curves can be used to determine the proper moisture content if the laboratory and field compactive efforts are the same. If not, sufficient trials will have to be made to correlate the two. Obviously the extensive experience of many organizations with soils in a limited area is a great aid toward determining proper field compaction procedures for soils which are frequently encountered.

The field compaction process is generally controlled by making frequent checks of the moisture content and density of the soil during rolling. The wet density is measured

● **Rubber-tired rollers are used for heavy compaction on highway and airport jobs.**

by one of several methods, the moisture content determined by rapid drying on a field stove or some similar method, and the dry density computed. The dry unit weight can then be compared with the compaction curve for the soil concerned to see if the density meets the requirement established in the laboratory. Of course, all of this must be done very quickly, since the contractor cannot be stopped in the middle of the rolling process while the tests are made.

Several methods are used to determine the wet density. In one method a cylindrical sampling tube of known volume is forced into the layer being compacted; the tube full of soil is weighed; and the wet density calculated. Other methods involve the digging of a cylindrical hole in the soil, weighing the soil taken from the hole, and determining the volume of the hole by means of heavy oil, rubber balloon equipment or sand density apparatus. The moisture content may be determined approximately by saturating the soil with gasoline or alcohol and igniting it to remove the water.

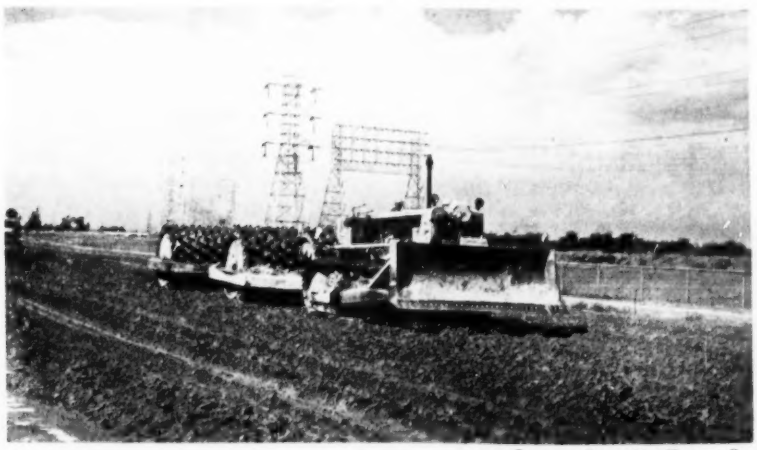
If the dry density is equal to or more than that specified, rolling may be stopped and another layer placed. If the density is less than that required then additional rolling may be needed or the moisture content adjusted. If these methods fail, it may mean that the equipment being used is not heavy enough, or the soil is not the one for which the laboratory curve was prepared.

If the moisture content is being maintained close to optimum, control may be based upon wet density. If things are going well, the inspector learns quickly to judge the moisture content by appearance or feel and the control process may be greatly simplified. He may also quickly decide that, with the proper moisture being maintained, a certain number of passes—say six or eight—will produce the required density. He may then keep count of the number of passes, with only occasional moisture and density checks.

Some soils are more sensitive to changes in moisture content than others. A sand generally will show a sharp peak on the moisture-density curve while clays are less sensitive. It is obviously impossible to maintain the moisture content at optimum for any considerable length of time, so that some tolerance must be permitted. An average figure for permissible deviation from optimum is one-tenth of optimum moisture.

On large jobs thorough investigation of the compaction characteristics of the available soils is essential, as is careful control of the field compaction procedure. A tremendous amount of detailed information relative to compaction has been published in recent years and the fundamental principles are well established. However, largely due to the fact that laboratory and field compaction do not give precisely the same results, there is still much to be learned. The engineer in charge of a large job may have to do considerable research to make sure he is achieving the results he wants in his compaction operations.

● **FROST damage may virtually destroy the usefulness of an improperly drained road.**



Courtesy Caterpillar Tractor Co.

● **SHEEPSFOOT rollers are used for compacting. This is the Los Angeles Freeway.**

Frost Action in Soils

One of the most important soil problems with which highway and airport engineers must contend in most areas in the United States is that of frost action. Two general sorts of damage—both of which can be very serious—are a result of frost action. These are "frost heave" during the winter; and the damage that may result when frozen ground thaws. The latter phenomena are sometimes categorically called the "spring break-up".

From a theoretical standpoint frost heave is a very complex process which seems to defy purely analytical solution. However, the general nature of the process is fairly well understood. When the air temperature drops below 32°F. and remains there for some length of time it is to be expected that the water in the larger voids of the soil will freeze. It is also to be expected that some increase in volume will occur, since water expands as it freezes. However, this change in volume is relatively slight and does

not account for the large heaves that sometimes occur.

Years of experience and investigation have disclosed several facts of importance which explain why severe frost heaves occur. First is the fact that water which exists in the small voids of a soil will not freeze at 32°F; lower temperatures are required. Thus, while a prolonged cold spell may result in freezing of the water in the larger voids to a considerable depth—down to the "frost line"—water in the small voids is not frozen and is free to move through the soil. Second is the fact that when water freezes it exerts a force which is similar to surface tension—the "crystallization force". This force can pull water from the water table and even from saturated or partially saturated soils above the water table. If ice forms in the upper soil layers—say, in a large void space or a crack—water is drawn through the small voids, accumulates and freezes; and the process continues. As the water accumulates distinct layers or "lenses" of ice form. It is the formation of these ice lenses which is the underlying cause of frost heave. In extreme cases the amount of heave may be 3 or 4 feet. Heave is, of course, particularly damaging to highways and to airport runways. It can cause rigid pavements to crack, flexible pavements to wave and fail, and destroy the foundations of small structures.

Courtesy Caterpillar Tractor Co.

● **COMPACTION test is being made on a highway fill job by a State Highway Department Technician. Job is on the Los Angeles River Freeway.**

It must be noted that certain factors must be present before severe frost heave can occur. First, there must be a favorable temperature gradient. By temperature gradient is meant, in general terms, the rate the temperature changes with depth. If the air temperature drops very sharply and remains well below freezing it is not likely that severe frost heave will take place; this is because the zone of the soil beneath the surface—in which the temperature is below freezing and yet the water in the voids is not frozen—is quite thin. The most severe frost heaves are likely to occur when the air temperature drops slightly below freezing and remains there over a long period of time, since there may be a thick zone in which the temperature is below 32°F but the water in the small voids is unfrozen.

Second, the soil must be one which is susceptible to frost heave. Here, as in our discussion of capillarity, the most severe condition is likely to occur in silt soils. The coarse soils are not susceptible to severe heave, since their void spaces are comparatively large and the water in them freezes as does ordinary water. Thus the heave in coarse soils is limited to the amount which water expands when freezing —about 9%. Clays are susceptible to frost heave but they are so impervious that the amount of water which can be brought up to form ice lenses is quite limited. Severe local damage may sometimes be caused by the accumulation of water in cracks or fissures in a clay soil.

The final requirement is that the water must be available in quantity. This generally means that the soil must be saturated and that the freezing zone must penetrate far enough to be close to the water table—within the effective height of capillary rise. Severe heave is not likely when the soil is partially saturated or the water table is deep.

Serious as the effects of frost heave may be, an even more damaging condition may occur in the spring of the year when the water accumulated in the frozen soil melts. A sudden thaw may cause this water to melt in the upper layers while at greater depths the soil is still frozen. Thus the water cannot escape and remains and the soil is extremely wet and may almost be a liquid. The important effect is that this excess of moisture greatly lowers the shearing resistance of many soils, thus greatly reducing or destroying their ability to support loads. The consequences can be very disastrous to pavements, as the term "spring break-up" indicates.

Construction and design measures which are intended to prevent damage from frost action aim at two of the three underlying factors, since little can be done about the weather. The most effective solution is to remove frost susceptible soils to the depth of frost penetration and replace them with suitable granular soils. This is the approach most frequently used in areas where clean sands and gravels are economically available.

Proper drainage may go a long way to prevent frost damage, particularly that which is associated with a high water table. Lowering of the water table, interception of seepage flow, and drainage of iso-

lated pockets of ground water may be effective. Blanket courses composed of 6 to 12 inches of coarse gravel or sand placed above the water table are frequently used to intercept capillary flow and prevent heaving. Similar layers are sometimes used as insulators to reduce the depth of frost penetration into the ground.

Indirect relief is afforded in some states by rigid control of truck traffic during the spring break-up in order to prevent damage to roads which have been weakened by frost action.

Example of Use of Soil Information in Design And Construction

In Fig. 21 is shown the soil profile along the centerline of a proposed rural highway which will carry heavy traffic. A flexible pavement will be used—in this case, an asphaltic wearing surface and a crushed rock base. The proposed grade line which is shown can not be changed appreciably because of the necessity of meeting the high level of the bridge and of other controlling factors which are not shown. The purpose of this discussion is to indicate how the information obtained in a soil survey and the accompanying laboratory testing program may be used in the preliminary design of the highway. Classification groups shown on the profile relate to the revised Public Roads system previously described.

The profile shown was obtained by auger borings made at intervals of approximately 500 feet along the centerline of the proposed location. At the tentative location of the bridge abutment a deep boring was made using mechanical drilling equipment. The bottom of the clay layer was established by auger borings made at the edges of the swamp and the deep boring at the bridge. It is believed that the profile shown is representative of soil conditions within the width of right-of-way of the proposed highway. The vertical scale of the drawing is, of course, greatly exaggerated. The highway is located in an area of moderate frost, with the depth of frost penetration normally being from 2 to 3 feet.

An explanation of the effects of the soils shown on the preliminary design may be conveniently divided into four portions, as follows:

(1). Station 42 to Station 51 + 50. —In this section the highway is to be built in fill. The maximum height of the fill will be about 6 feet. As indicated, a portion of the area is a swamp, with from 2 to 3 feet of highly organic silt, which has low shearing resistance and is highly compressible. The following considerations will influence design and construction procedures.

(a) Even though the fill is relatively low, conservative practice calls for a removal of the organic soil shown, since it is very shallow and relatively easy to excavate. The reason for removal is simply to avoid trouble that *might* be caused by the consolidation of this material or by a shear failure under the weight of the embankment.

(b) The material which is to be taken from the cut of the next section—Station 54 + 50 to Station 74—will make an excellent fill. In fact, it is probably good enough to be used in base construction if it is needed for that purpose. The organic material is to be removed from the swamp, the A-1 material used to replace it, and the fill built by conventional methods using regular compaction equipment. Side slopes of the fill need be no flatter than 2 to 1 and may be 1½ to 1, if necessary. This material is not susceptible to detrimental frost action and the water table is about 3 feet below the proposed grade line.

(c) The silty sand should provide adequate support for the fill. It is further believed that the weight of this relatively low fill will not be enough to cause appreciable settlement because of consolidation of the silt and clay layers.

(2) Station 51 + 50 to Station 74.

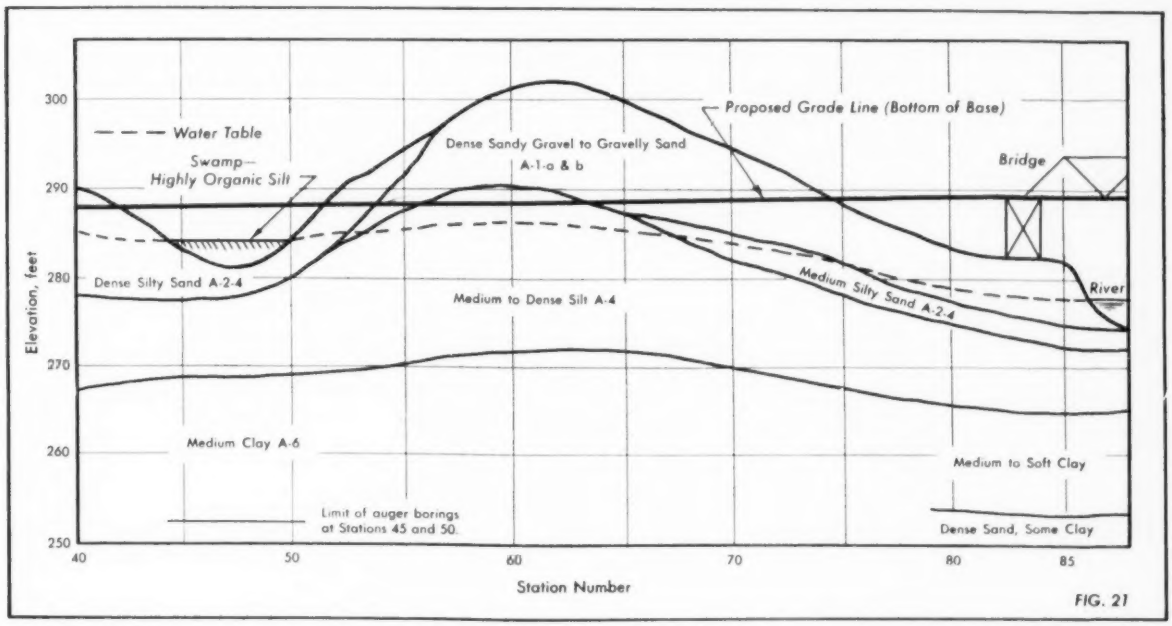


FIG. 21

● **SOIL PROFILE along the center line of a proposed highway, as obtained by borings. Text indicates method of using data.**

—This section is in cut, as indicated. However, several problems are presented because of the fact that the water table lies close to the proposed grade line. The grade will also cut through the silt for several hundred feet. Two problems are associated with this combination. One is the effect of capillary action; the silt subgrade may be saturated much of the time and thus may have very low shearing strength. The other is frost action, which will inevitably produce severe heaving during the winter months and a great reduction in shearing strength of the silt during the spring. Two possible solutions suggest themselves.

(a) The water table may be lowered by the use of subdrains. This probably would not be a complete solution in itself, since the water table can not be lowered too much—maybe 3 to 4 feet—since underground drainage is from the swamp toward the river. Thus, the water table cannot easily be lowered to more than 6 or 7 feet below the proposed grade line; the height of capillary rise in the silt may be 10 feet or more.

(b) The second possible solution would be to use a substantial thickness of granular subbase in this section. This will be effective, since the granular material will stop the capillary movement of water toward the surface. The subbase would be used over the entire length of the section in which the silt is to function as a subgrade. The thickness of the subbase would be determined by the shearing strength of the silt, the design method in use by the agency concerned, and experience. It may be as much as two feet. It will serve to "spread" the stresses which will result from wheel loads applied to the pavement surface; the silt should then be able to carry these loads satisfactorily.

(c) As a final possibility, consideration might be given to the combined use of a subbase and subdrains in this section. It is possible that lowering of the water table to a certain extent will make it possible to use a somewhat thinner subbase.

(3) Station 74 to the Bridge Abutment (Station 83).—No particular soil problems should be encountered in this section, assuming that there is sufficient A-1 material to form the fill for the bridge approach. The bridge abutment will probably have to be designed to withstand the lateral thrust from the fill. Some calculations and judgment may be necessary in selecting the location of the abutment in terms of increased length of bridge span as compared with an increased amount of fill.

(4) Bridge Abutment (Station 83).—Several problems associated with the behavior of the soils beneath the bridge abutment are apparent.

(a) The weight of the abutment and the loads that come on to it from the bridge will undoubtedly cause settlement due to consolidation of the underlying silt and clay soils if a shallow foundation is used. The amount of settlement can be accurately estimated only if undisturbed samples are taken from these two layers and a settlement analysis made.

(b) The bearing capacity of the A-1 and A-2-4 materials should be sufficient to support adequately a shallow foundation for the abutment. However, the possibility exists that a shear failure may occur along the boundary between these materials and the silt layer, in the silt, in the clay, or on some other deep sliding surface. This possibility may be increased by the seepage flow of water toward the river. A check of the stability should thus be made. Methods to be used in such an analysis have not been discussed in this article, but are available in standard references on soil mechanics. The solution will depend upon an estimate of the shearing strength of these materials based upon tests on undisturbed samples.

(c) Since these difficulties may be serious if a shallow foundation is used, the best solution probably will be to found the bridge abutment upon piles. The piles should be driven into the underlying layer of sand and gravel; they probably will not have to be more than 50 feet in length. Since the abutment will probably be designed to restrain the fill and, in addition, may be subjected to lateral forces from the bridge, both vertical and batter (inclined) piles will be needed.

(d) Regardless of the type of foundation which is finally selected, careful examination must be made of the characteristics of the river, particularly during flood stage, to insure the safety of the foundation against failure due to undermining or "scour" of the river bank.

SOIL ENGINEERING

This is the third and concluding installment of "Soil Engineering" by Leo J. Ritter, Jr. For the convenience of our readers the three articles will be reprinted in booklet form. Watch for an announcement.

—The Editors

Soil Engineering Bibliography

1. "Highway Engineering", Ritter & Paquette, Ronald Press Company, New York, 1951

2. "Introductory Soil Mechanics and Foundations", Sowers and Sowers, MacMillan Company, New York, 1951

3. "Soil Mechanics in Engineering Practice", Terzaghi and Peck, John Wiley & Sons, Inc., New York, 1948

4. "Fundamentals of Soil Mechanics", D. W. Taylor, John Wiley & Sons, Inc., New York, 1948

5. "Classification and Identification of Soils", A. Casagrande, Transactions, American Society of Civil Engineers, 1948, p. 901

6. "Classification of Highway Subgrade Materials", Proceedings, Highway Research Board, Washington, D. C., 1948

7. "Methods for Making Highway Soil Surveys", K. B. Woods, Proceedings Separate No. 152, American Society of Civil Engineers, New York, 1952

8. "Frost Action in Soils—A Symposium", Special Report No. 2, Publication No. 213, Highway Research Board, 1952

9. "Standard Specifications for Highway Materials and Methods of Sampling and Testing", Parts I and II, 6th Edition, American Association of State Highway Officials, Washington, D. C., (1950)

10. "Procedures for Testing Soils", American Society for Testing Materials, Philadelphia, Pa.

11. "Report of Committee on Calcium Chloride Soil Stabilizations", Technical Bulletin No. 154, American Road Builders Ass'n., Washington, D. C., (1947)

12. "Compaction of Embankments, Subgrades and Bases", Highway Research Board, Bulletin 58, Washington, D. C., (1952)

HOW A 64-YEAR OLD SEWER WAS RELINED

WALTER P. SCHMITZ, Asst. Construction Engineer, Milwaukee, Wisc.

● **DISTORTION** of the crown of the old brick sewer is clearly indicated.

MORE than 60 years ago, in 1889, to be exact, Milwaukee constructed a 96-inch combined sewer in Becher St. The sewer, which is at a depth of about 30 ft., is of brick, three rings thick. Four years ago an inspection showed that the sewer was in poor condition, with distortion from true round to an approximate egg-shape with the long axis horizontal. The roof showed signs of caving. In 1951, further movement was noted and it was decided to reconstruct the sewer. Surveys of the interior were made and it was determined to line a section about 1220 ft. long.

Consideration was given to removal of the old brick structure and replacement with a monolithic concrete structure; to lining the old sewer with reinforced concrete; and to lining it with corrugated metal pipe. The third alternative was selected because reconstruction would not entail disturbance of the existing structure, the cross-sectional area would be decreased only slightly and estimated costs were lower.

Cross-sectional measurements of the old sewer were made at 25-ft. intervals and from these it was decided to use a pipe having a nominal diameter of 89 ins., and to deform it during manufacture to conform to a section of 92 ins. on the horizontal axis and 86 ins. on the vertical axis. It was decided to use Armco asbestos-bonded corrugated pipe. The low bidder on the project was W. J. Lazyinski, Inc., of Milwaukee, with a total of $118,772.22, based on pipe at $88.10 per foot and grout at $60.00 per cu. yd.

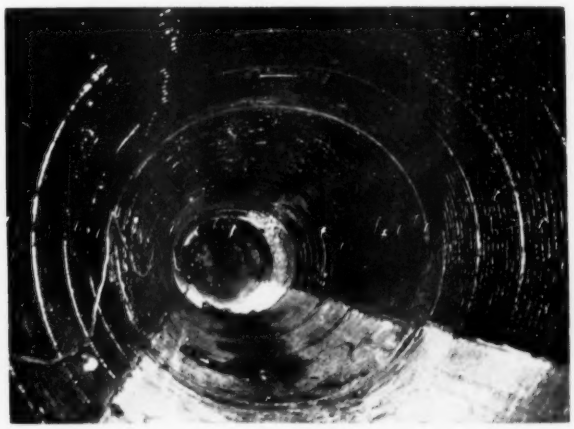
The work involved excavation of a shaft in the street near the center of the project; placement of the pipe in sections not shorter than 8 ft. or longer than 20 ft.; jointing of the pipe; and grouting, not only between the pipe and the old brick, but also behind the brick. Excluding manhole areas, 1212 ft. of pipe were required.

The dry weather flow in the sewer was diverted to another 90-inch sewer in the same street; the sewer was swept clean of sediment and debris; and such projections as would interfere with the placing of the pipe lining to grade and line were removed. For access to the sewer, manholes were available at both ends of the line; and the work shaft also provided for entry.

The sections of the pipe were lowered to the sewer through the work shaft and carried forward into the sewer on a dolly. The sections were then placed securely in line and grade and banded together. The annular space between the corrugated pipe and the old brick was then filled with grout. Later, the area outside the old brick sewer was pressure-grouted. Where a branch line entered the sewer, a special corrugated pipe intake was installed.

John Drake was General Superintendent for the contractor. For the City, Lloyd D. Knapp is City Engineer; Edmund Hirsch is Engineer in charge; and E. A. Schmidt is Construction Engineer.

● **BANDING SECTIONS** of asbestos-bonded corrugated pipe.



● **PIPE IN PLACE** before grouting. Note paved invert.

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APWA News

AMERICAN PUBLIC WORKS ASSOCIATION
1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

APWA STUDY REVEALS SEWER REVENUES FOR 579 MUNICIPALITIES

Reports Indicate One-third of Municipalities over 5,000 Charge for Service

The results of studies conducted by the American Public Works Association indicate that sewer service charges are now in effect in about one third of all municipalities in the United States above 5,000 population. A list of 579 of the total estimated 750 cities using these charges is included in a Special Report soon to be released by the Association. Such charges are reportedly used by cities of over 5,000 population in 45 of the 48 states. Kansas, which passed legislation this year authorizing the use of such charges, is believed to be the last state to grant such authority for cities of this size.

Total revenues received for the 1952 budget year from this source are reported by 233 municipalities. The average per capita revenue for 15 cities over 100,000 population was $2.57. The average

(*Continued on page* 109)

FILM OF THE MONTH IS "NEW SEWERS FOR OLD"

NEW SEWERS FOR OLD is the name of the feature film this month. It was produced by, and is available through, the Armco Drainage & Metal Products Company of Middletown, Ohio. This new 16 mm. sound film is in color. It runs 15 minutes and pictures the various steps involved in replacing the antiquated sewers in a growing industrial community (of 35,000 population) with Asbestos-Bonded, corrugated metal pipe with paved inverts. The film also illustrates three tunnels of 108-inch diameter which were dug under railroad tracks, using steel lined plates and then threaded with 96-inch diameter Asbestos-Bonded sewer pipe. A special trench shield, metal saddle branches and house connections are other features of this new film which you can borrow for showing at no charge, except return postage, from Armco Drainage & Metal Products, Inc.

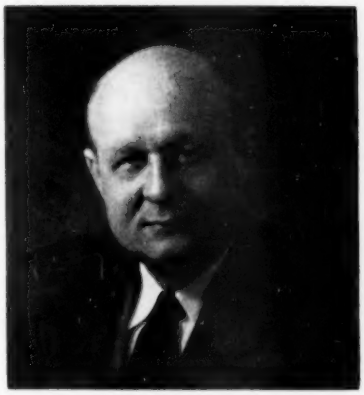
Val Peterson, Federal Administrator of Civil Defense, Featured Speaker at Annual Public Works Congress

Wyler Reports New Orleans Going All-Out to Make Meetings Memorable

CHICAGO, ILL.—Enthusiasm and Interest in the coming Public Works Congress and Equipment Show is at an all-time high. Albert Wyler, New Orleans City Engineer and General Chairman of the 1953 Congress reports that the City is going "all out" to make this an experience that will long be remembered.

An added feature on this year's program will be an address by Governor Val Peterson, Administrator, Federal Civil Defense Administration, on Tuesday Morning, October 27. His topic—"The Backbone Of Civil Defense"—will be of special interest to all public works officials. (Other topics on the program were included in the September issue of this magazine).

Over thirty members of the Association will receive the Samuel A. Greeley Service Awards at the Annual APWA Dinner, Thursday evening, October 29. These awards are presented to public works officials who have served their cities over thirty years and who have been a member of the Association at least 5 years. The Charles Walter Nichols Award, consisting of a $500 honorarium, will also be presented to the candidate selected by the Awards Committee for the most outstanding and meritorious achievement in the field of sanitation during the past year.



Val Peterson

The speaker at the Annual Dinner will be Clay Shaw, Managing Director, Louisiana Purchase 150th Anniversary Association; whose subject is "Highlights of the Louisiana Purchase".

Hotel reservations can still be made by writing to the Housing Committee, 1953 Public Works Congress and Equipment Show, Room 415, City Hall Annex, New Orleans 12, Louisiana.

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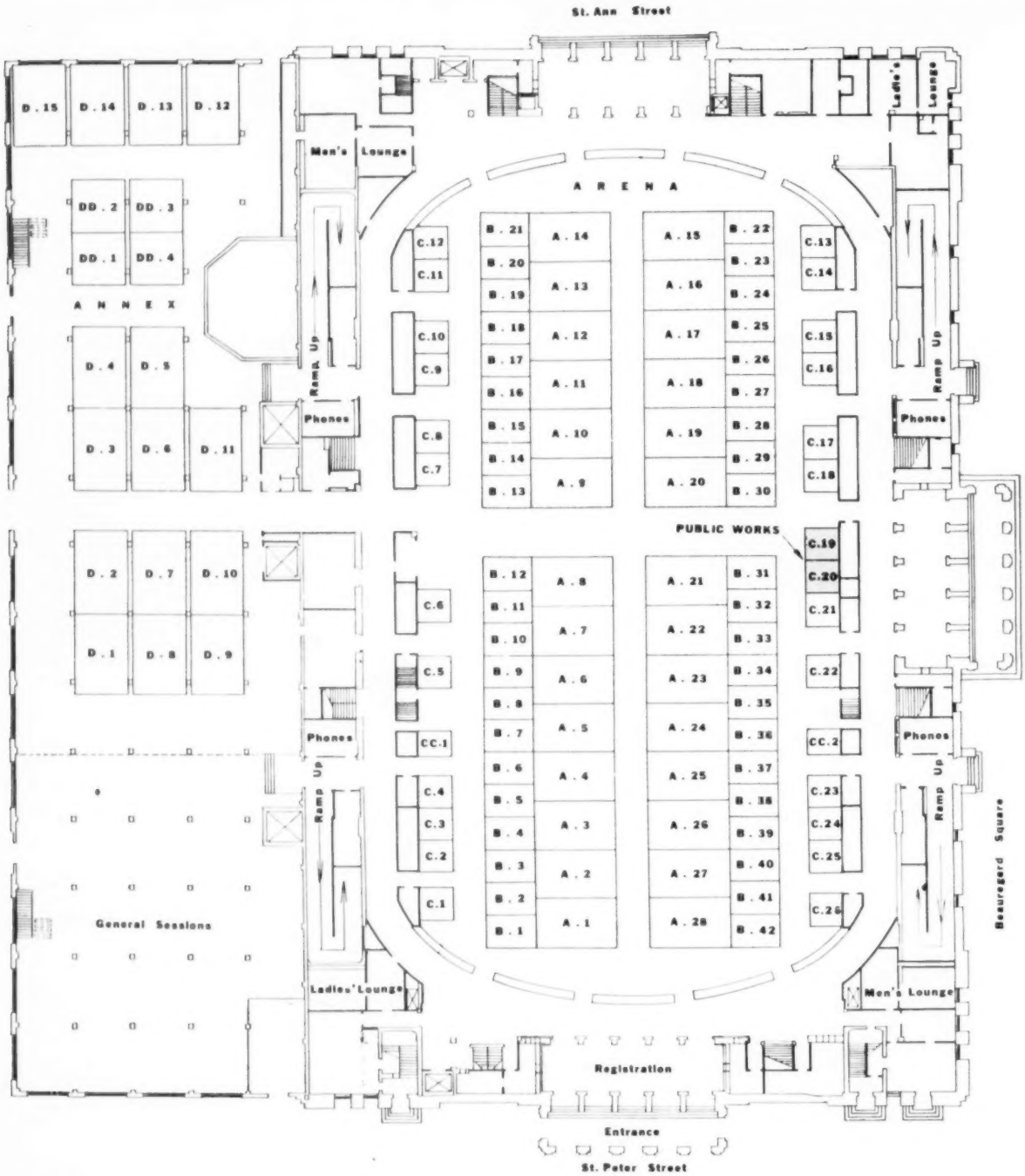
NEW YORK-NEW JERSEY CHAPTER TALKS ABOUT WINTER MAINTENANCE

Weather Forecasting Featured

ESSEX FELLS, N. J.—Essex County, New Jersey, was host for 236 members and friends of the New York-New Jersey Metropolitan Chapter at the Fall meeting of the group, held at Essex Fells, New Jersey, on September 23rd. The problems of winter maintenance, which are complicated in this area by heavy commuter traffic, were discussed by Curtis C. Colwell, Essex County Engineer. Essentials for adequate preparation, as outlined by Mr. Colwell, include readiness of equipment and materials, route or-

(*Continued on page* 109)

PLAN OF THE EXHIBIT HALL FOR APWA CONGRESS



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Sewer Revenues

(*Continued from page* 107)

for the other municipalities reporting is $3.20 per capita. Using these averages, APWA estimates that over 80 million dollars annually is being collected in the form of sewer service charges in cities of over 5,000 population that now use such charges.

The average monthly charge for the 12 cities over 100,000 population is $.57, while the average monthly charge in the other cities reporting is $.82.

The principal basis used in fixing such charges and the practices followed for billing and collecting these charges are also discussed in this new publication available from the Association's Headquarters Office in Chicago.

NY-NJ Chapter

(*Continued from page* 106)

ganization, communications by two-way radio and full use of meteorological services to pinpoint the time and intensity of snow and ice conditions.

The services of the United States Weather Bureau were described by Ernest J. Christie, Chief Meteorologist of the Bureau's New York office, who pointed out that every effort is made to provide up-to-the-minute data to industries and governmental organizations whose operations are affected by the weather. Following Mr. Christie's talk, the role of the private meteorological consultant was presented by Frank Romaine, eastern representative of Weathercasts of America. In this relatively new field, the consultant provides municipal officials with a comprehensive study of special problems in addition to a continual evaluation of weather conditions which might require plowing or salt and abrasive spreading.

The meeting provided public works men with an opportunity to inspect and see demonstrations of a wide variety of equipment displayed by manufacturers and their representatives. An inspection trip also was made to the sewage treatment plant which serves the Essex County Overbrook Hospital.

Hebden to Discuss New HRB Report

WASHINGTON, D. C.—"Intergovernmental Cooperation in Highway Affairs" is the title of Special Report No. 9 recently published by the Highway Research Board. This report gives the findings of a cooperative research project sponsored by the American Public Works Association and other national organizations. The report contains the recommendations for effective intergovernmental relationships agreed upon by an Advisory Committee. Harmer E. Davis, Director, Institute of Transportation and Traffic Engineering, University of California headed the project.

Mr. Hebden will discuss the recommendations made in the report when he participates in a Symposium on "Intergovernmental Relations In Public Works" at the coming Public Works Congress in New Orleans, October 26-29.

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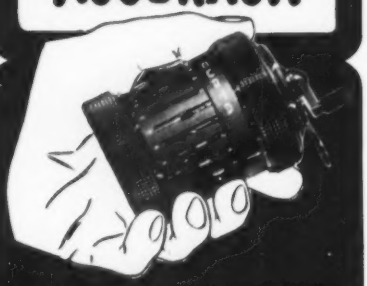

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Washington news

Presented in cooperation with the American Public Works Association and through the courtesy of the Washington Office of the American Municipal Association.

EXPENDITURES for new construction this year are expected to reach $34 2/3 billion, exceeding last year's record by 6% or $2 billion, according to a revised outlook of the U. S. Department of Commerce and U. S. Department of Labor. This year's dollar volume of new construction will represent a new peak of work actually put in place.

Private and public construction both will share in the 1953 rise. Public construction, at $4.4 billion is expected to be at an all-time high *both* in dollar volume and in physical plant installed, marking the tenth successive year of expansion. Atomic energy construction expenditures are expected to rise about 15%. Military and naval construction is expected to be about the same as 1952. Expenditures for two important civilian types of public construction—highways and schools—will probably rise by 10 and 8 percent respectively this year, to new record levels both in dollar volume and in physical capacity provided. Most of the funds involved in this construction are from state and local sources.

Mobilization Responsibilities

Largely as a result of timely intervention of The American Public Works Association in cooperation with The American Municipal Association, an attempt to transfer assignment of mobilization responsibilities for water, sewerage and waste disposal facilities away from their traditional relationship in the Public Health Service, was forestalled. Under the proposed plan, public water, sewerage and waste disposal facilities requirements would have been lumped in with private industry's. This means that there will remain in effect:

a. the mobilization responsibilities assigned to the Department of Commerce for priorities and allocations, preparation of limitation orders, and determination of components requirements; and

b. the mobilization responsibilities assigned to the Department of Health, Education, and Welfare (Public Health Service) to determine requirements for copper, steel, and aluminum (feasibility test) required to support the water works and sewerage works industry within the demands of programs established by the Office of Defense Mobilization for hypothetical war years.

GSA Materials Division

Establishment of a Materials Division in the General Services Administration has been announced by Administrator Edmund F. Mansure. The new Division will take over the procurement responsibilities for metals and minerals formerly handled by the Defense Materials Procurement Agency. The new Division's head will be Irving Gumbel, who had been Acting Deputy Administrator of DMPA. The division will be under the general supervision of Emergency Procurement Service Commissioner, A. J. Walsh.

Advisory Committee

The Public Works Advisory Committee may be re-established by the General Services Administration. Washington sources predict an early committee meeting to undertake the problem of advising the Federal government on public works planning—construction and operation. The American Public Works Association formerly had a representative on the committee, whose principal activity of late has been in revising the government construction contract form—(form 23). Re-establishmet of the committee would give public works people a direct pipeline to government agencies on public works problems and prospects.

Interior view—7,200,000-gallon steel reservoir under construction in the Pittsburgh district, showing roof framework before center course of roof plates was completed.

Exterior of the South Pittsburgh Water Co. reservoir, during construction. Unit is 116 feet in diameter, with 95 feet head range.

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2,500,000-gallon radial cone elevated steel tank under erection for South Pittsburgh Water Co., showing tubular columns, riser and several radial girders in place. Tank is 112 feet in diameter; head range 35 feet; height to high water line 165 feet.

(Continued from page 79)

Network Calculator

Perry and Vierling developed a similar method using a D-C calculator.

In solving hydraulic problems by the Hazen and Camp method, a value for the flow is assumed and readings are successively adjusted to satisfy equations expressing the requirements of nonlinear resistance, Equation 1: when h corresponds to E; (rQ^{n-1}) corresponds to R; and Q corresponds to I.

Thus **R** is no longer constant, but a function of the constant **r** and the variable **Q**; consequently it was necessary for Camp and Hazen to assume values of **Q**, read values of **R**, and, knowing **r**, determine their error in **Q** from the relationship:

$$r = Q^{n-1} = R \qquad (3)$$

Their next assumed Q values were determined as is done in the Hardy Cross method. Thus, this method is essentially similar to the Hardy Cross method, but is more rapid in that the entire system can be adjusted at one time. The same number of successive approximations should be sufficient for each method.

One of the objectives of the work of Camp and Hazen was to obtain all of the flow and pressure data directly from the network calculator. They were successful in accomplishing this aim, but, again, only by a time-consuming method of trial-and-error adjustment. Though all three requirements can be partially satisfied by the Hazen-Camp method, this method is still one of successive approximation.

Suryaprakasam, Reid and Geyer (11) developed a method whereby the results produced by the A-C network calculator can be corrected to within five percent accuracy of the true hydraulic values. The correction of the linear to nonlinear relationship is based on data already available, namely the ratio of resistances in a single loop. In practice, the linear values of flow are read from the A-C network calculator. The equivalent resistance of every element is calculated, as well as the ratio of resistances in each loop. Then the percentage correction in flow is read from a plot of the loop resistance ratios vs the difference in flow for linear and nonlinear relationships for a single loop. The head losses are computed from the adjusted values of flow and then balanced by distributing the net difference in head loss for each loop among the loop elements in proportion to the calculated head loss of the individual element.

Reid developed another approach to this problem, one simply of attention to head loss values developed as a result of the linearly computed values of **Q**. This technique was found to give values of **Q** in good correlation to the Hardy Cross analysis in most cases, but

TABLE 1—Flow in Elements of Fig. 1 in Percentages of Inflow.

Element	1	2	3
3	42.2	43.5	40.0
4	21.4	25.9	23.8
2	29.1	27.5	30.0
1	57.8	56.5	61.5
2	29.1	27.5	30.0
7	32.4	33.9	34.5
6	18.4	19.9	19.6
5	28.4	29.9	29.4
9	20.8	17.6	22.4
10	10.8	7.6	9.6
8	18.1	18.6	14.6
4	21.4	25.9	23.8
8	18.1	18.6	14.6
12	28.9	26.2	30.0
11	51.1	53.8	49.6
7	32.4	33.9	34.2

(1) By the Hardy Cross method; (2) by procedure of Suryaprakasam, Reid and Geyer; (3) by Reid method.

8 (of 14) Climax 12 cylinder, 510 H.P. Gasoline Engines driving Peerless 48" Propeller Type Vertical Storm Water Pumps, each having a capacity of 45,000 GPM against a 28-ft. Head.

A NEW seven million dollar sewage disposal system, designed by and constructed under the supervision of Hubbell, Roth & Clark, Inc., Detroit, has recently been placed in operation for Saginaw, Michigan. Included in the system are five storm water pumping stations, two of which are equipped with a total of fourteen Peerless 48" propeller type vertical pumps, each having a rated capacity of 100 c.f.s. (45,000 GPM) All 14 are driven by Climax 12 cylinder, 510 H.P. gasoline engines. Reliable and independent power is provided as utility power failure is frequently caused by electrical and atmospheric disturbances associated with floods.

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unfortunately, the few that deviated, did so considerably; and values obtained by the Suryaprakasam, Reid and Geyer correction factor method appeared more reliable. The technique used was to compute the head loss from the linear flow values, and determine a correction factor "f" which was simply the difference in head loss for the element in question, divided by the total head loss for the loop. This factor was then raised to the 0.54 power and multiplied by the linear value of **Q** to give an adjusted **Q** according to balanced head losses.

Results obtained by these two methods and by the Hardy Cross method for the network in Figure 1 are compared in Table 1.

The mathematical adjustments required in the Hazen-Camp method are taken care of through instrument adjustments in the so-called Purdue method, by Stephenson, Spencer, Rockwell and others (10). The method is one in which the existing relationship between current and voltage in each network element are compared with the desired relationship by means of a cathode ray oscilloscope used as an indicator. Approximate corrections are made by reference to the inclined trace on the screen and a curve plotted in accordance with the particular nonlinear equation drawn in ink on the screen.

REFERENCES

1. Fair, G. M., Hydraulic Investigation of Water Distribution System in Field and Office. Jour. NEWWA, 55:271 (June 1941).
2. Farnsworth, George, and Rossano, August, Application of the Hardy Cross Method to Distribution System Problems. Jour. AWWA, 33:224 (Feb. 1941).
3. Anon., Hardy Cross Analysis of Flow in Networks of Conduits and Conductors, Bul. 286, Univ. of Illinois Expt. Sta., Urbana, Ill. (1936).
4. Doland, J. J., Simplified Analysis of Flow in Distribution Systems. Eng. News-Rec., 117:473 (1936).
5. Gavett, Weston., Computation of Flows in Distribution Systems, Jour. AWWA, 35:282 (March 1943).
6. Camp, T. R., Hydraulics of Distribution Systems — Some Recent Developments in Methods of Analysis. JNEWWA., 47:344 (December 1943).
7. Anon. Water Works Engineering in Disaster. Pub. 2022, Office of Civil Defense, Washington, D. C. (December 1943).
8. McIlroy, Malcolm S., Direct-Reading Electric Analyzer for Pipeline Networks. Jour. AWWA, 42:347 (April 1950).
9. Camp, T. R., and Hazen, H. L., Hydraulic Analysis of Water Distribution System by Means of an Electric Network Analyzer. JNEWWA., 48:342 (March 1938).
10. Stephenson, R. E., An Adaptation of Electrical Network Analyzers to the Study of Fluid Flow in Pipe Line Networks. Thesis, Purdue University, 1952.
11. Surpayrakasam, M. V., Reid, G. W., and Geyer, J. C., Use of Alternating - Current Network Calculator in Distribution System Design. Jour. AWWA, 42: 12 (December 1950).

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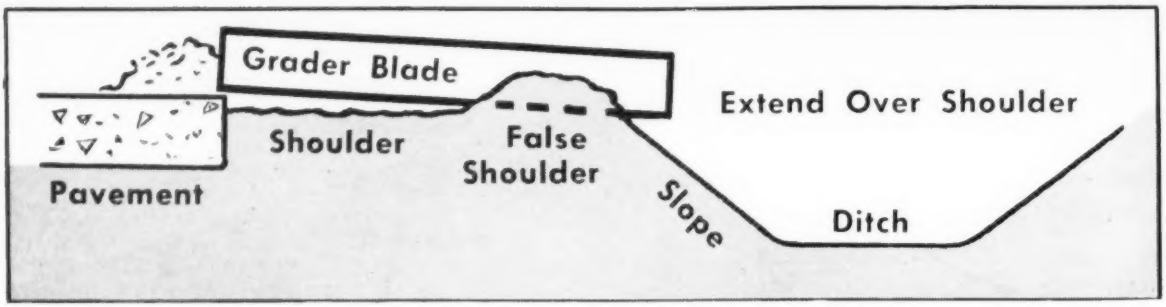

New Shoulder Maintenance Methods

FALSE shoulders and ruts along the paved edges of highways have always been headaches for those in charge of road maintenance. They are a prime factor in shoulder erosion and break-up of pavement. As the sod builds up at the outer edge of the shoulder, it prevents drainage to the ditch and causes shoulder material to wash away. The drop-off along the pavement edge becomes deeper and deeper. Water seeps under the pavement, softening the base and causing breaks in the road.

The problem of false shoulders can be licked at low costs with a good motor grader. The photo herewith shows such work being done with an Allis-Chalmers motor grader with a Tractomotive rear-end loader and a shoulder maintenance blade.

With such a machine and one operator, the false shoulder is removed; sod is loaded into trucks for disposal; the shoulder is reshaped; drainage is restored; and the correct shape of the shoulder thereafter can be maintained easily.

The first operation in correcting this shoulder condition is to cut the sod with the grader blade and to roll it to the edge of the pavement, or onto the pavement if the shoulder is narrow. The outer end of the grader blade must extend over the shoulder slope to assure a clean cut and to eliminate cutting another false shoulder which would further prevent drainage.

The windrow of sod left by the grader usually consists of a root mat with very little dirt or gravel. The precision cut of the grader eliminates the false shoulder but does not disturb the shoulder gravel. Sod is difficult to handle and expensive to break up. The most satisfactory method of disposal is to haul it away in trucks. A rear-end loader on the grader provides an economical means of loading the sod. Truck and grader straddle the windrow, with the truck being loaded from the rear. Back and forth movement of the grader's tandem drive wheels during the loading compacts the shoulder material along the edge of the pavement. Loading is done far enough on the side of the road to give little interference to traffic.

The next step is restoring the shoulder to the correct shape, and then maintaining it. With the equipment shown, the bucket is removed from the loader booms and the shoulder maintenance blade mounted in place with the same pins used to attach the bucket. The shoulder is shaped with the grader blade. As it is being shaped, the operator feathers the windrow out behind him with the shoulder maintainer. Material from the grader blade is rolled up to the edge of the pavement and directly in front of the tandem drive wheels. These wheels compact the material before it is feathered by the maintainer blade. Compaction at this point is important to eliminate the drop-off at the pavement edge and keep shoulder material in place under conditions of traffic use.

The finished job is a smooth, safe, well-drained shoulder, easy to maintain in the best possible condition at low cost. The corrected shoulder has the effect of widening the highway and provides ample off-pavement space for drivers in case of emergencies.

● **SHOULDER shaped with grader moldboard and windrow behind feathered with shoulder maintenance blade.**

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This illustration proves the remarkable strength of Wolverine electric-welded steel tube. Despite all the twists you see here, this piece of tube — made up of several sections of Wolverine electric-welded steel tube soldered together with Flagg malleable fittings — withstood a pressure test of 7500 p.s.i.

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Expediting Sewer Pipe Jacking

By using a multiple nozzle, with jets working in five different directions, a crew was able to jack an 18-inch steel pipe, used to house a sewer conduit, a distance of 40 ft. in 7½ hours. This idea was reported by Cicero Smith, Sup't. of Public Works, Forest Grove, Ore.

• • •

Field Telephones Speed Sewer Cleaning

War surplus field telephones are used for communication between single drum Champion sewer cleaning machines according to Harold Hultquist, Sup't. of Public Works, Livonia, Mich. This is an ideal arrangement when obstacles exist between manholes which are some distance apart.

• • •

New Life for Road

(*Continued from page* 86)

existing material proved satisfactory, 1298 bags of cement were incorporated into the existing gravel. This made an exceptionally rigid base. On the remaining nearly 2 miles of widened base, 3 inches of bituminous concrete base were added after removing the top 3 inches of gravel. This was done to bring the widened area up even with the adjacent concrete pavement and to give extra support to the new pavement wherever it extended beyond the old concrete pavement.

TABLE 1—SURFACE COURSE AGGREGATE GRADATION

Sieve Size	*Percent Passing*
3/4-in.	100
1/2-in.	70-88
No. 4	46-60
No. 8	32-47
No. 40	10-26
No. 80	4-18
No. 200	0- 8

All the work, except the surface, was done by a state maintenance crew but bids were taken for the bituminous concrete for the 2-inch surface and 3-inch base course. A price of $7.70 per ton was secured for the bituminous concrete material in place. The contractor moved a crusher and portable asphalt plant into a gravel pit about 6 miles from the project and manufactured the paving material from crushed gravel. This was mixed with sand to meet the gradation shown in Table 1 and 5 to 7 percent of bituminous binder was used.

The total cost of the project was $94,804.30, which included bituminous material $500.00; miscellaneous material $416.31; culverts $1,784.64; gravel stumpage $1,378.57; labor and equipment payroll $37,005.89; inspection and Right-of-Way $433.52 and pavement $53,285.37.

After completing the work the average speed of traffic was stepped up from 25 to 40 miles per hour and except for peak hours there is no traffic congestion. One year after being opened to traffic no cracks have appeared and from the appearance of the surface it is impossible to detect where the old cement concrete pavement and the widened area join each other.

• • •

Phoenix Meets People

(*Continued from page* 75)

the discussion was to be kept nonpolitical in nature.

"We wanted to know what our citizens were thinking about," Mayor

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Foster explained, "and what they thought of the city services. We wanted to know what the most pressing needs were and where we could improve our services. The meetings provided plenty of answers, and they gave us an opportunity to explain how the city operates."

The "Know Your City" forums brought out one fact with great clarity: The average citizen knows very little about how city services are brought to an area. Many people asked why the city had not paved the streets in their area, put in sewers, or provided other services. They were often surprised to learn that such services normally are paid for by the property owners of the area concerned. Others were amazed to learn that stop lights are erected only after careful traffic studies, and that lights do not always reduce the number of accidents at an intersection. Still others, dissatisfied with the frequency of garbage and trash collections, went away more content when they learned that increasing the frequency would result in higher costs to the homes served.

Zoning problems came in for plenty of discussion, as did city bus service, speed control on city streets, fly suppression, fire fighting services, city recreation programs, and a hundred other subjects. Questions on city finance were rare, probably because few persons attending had sufficient grasp of municipal finance to ask questions. But the council managed to inject enough information on money matters into the discussions to dispel a somewhat prevalent idea that the city had unlimited funds to use in making improvements.

Who Attended

The meetings attracted people from every social stratum, many racial groups, and virtually all educational levels. Clearly evident in this heterogeneous group was a common desire for more knowledge of how their city is operated. Attendance of two and three hundred at the meetings was commonplace, and many thousands of others followed the reports of the meetings in the press.

Although the people attending learned a lot, the city officials learned just as much.

There was the meeting, for example, when residents of a predominantly Negro section of the city complained that only pop and candy were being sold at Eastlake Park, which serves children of that area. Parents who wanted to send their children to the park for the day asked that the refreshment stand include sandwiches and other solid foods on its menu. The Parks and Recreation Department director agreed at once to correct the situation. At the same meeting the Council agreed to have the Eastlake Park parking lot oiled to keep down the dust.

At another meeting the city officials learned that residents in the vicinity of a horse racing plant within the city limits were undergoing hardship as the result of the fact that track patrons took up parking spaces in front of every home for blocks around. A study has been started to see how the problem may be corrected. If there is no practicable solution, the track may be declared a nuisance and moved to an outlying site.

Hundreds of individual complaints, extending to the services of every department, were noted and a large percentage have already been corrected.

Not everybody could be pleased, however. A notable example of that was the meeting in which a large group of irate property own-

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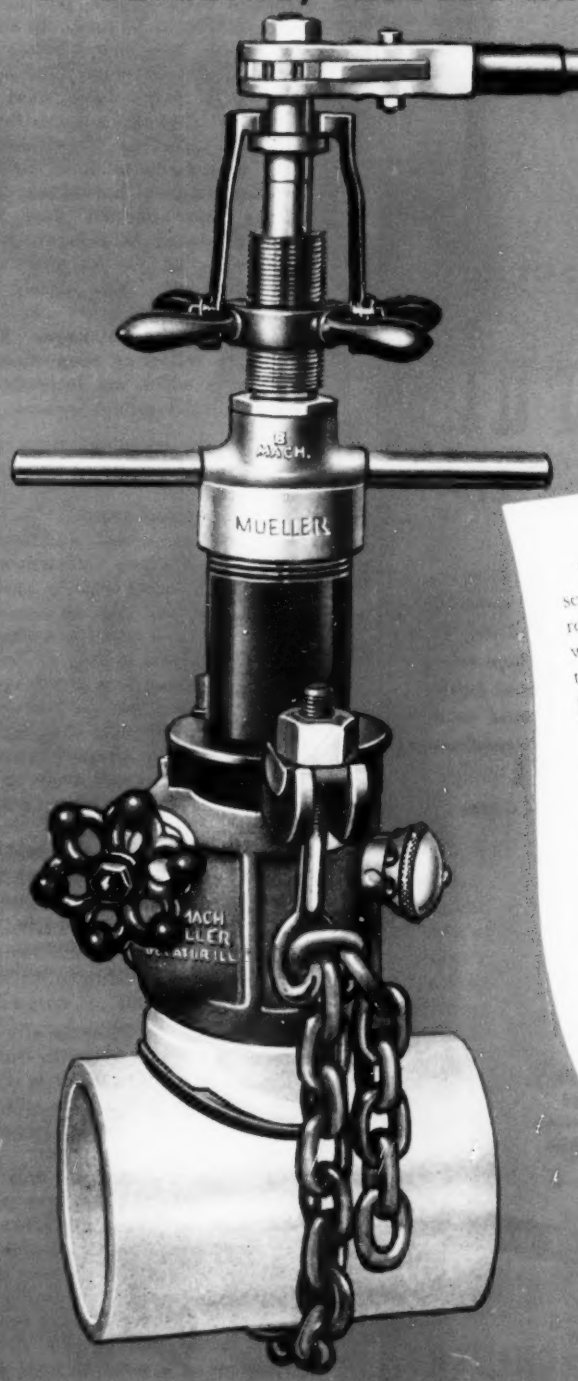

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ers appeared to protest the establishment of a truck route through the southern part of Phoenix. They were particularly unhappy about property assessments which had been levied as far as four blocks from the street serving as the truck route.

The problem had been aired at a well-attended public hearing several weeks previously, however, and decisions on the matter had been reached. So, when it became evident that the truck route problem was going to occupy a major portion of the "Know Your City" meeting in that area, Mayor Foster briefly summarized the situation, explained how it was to be handled, and announced that no more discussion of the matter would be allowed at that time.

Despite the fact that everyone's problem could not be solved at the meetings, the city officials were able in most cases to clear up misunderstandings and to assure each citizen that the situation in question would be (1) corrected when conditions permitted or (2) not corrected because of conditions which were carefully explained.

Moreover, they provided an opportunity for department heads to explain their plans for future developments in their departments. Timetables on street improvements, extension of sewer and water facilities, park improvements, and many others were announced and explained.

The Phoenix city administration exhibited considerable fearlessness when it decided to hold the series, considering the opportunities the meetings offered for political opponents who might have used the forums to blast the administration; but apparently no organized attempt was made to turn the sessions into political harangues. Most citizens who attended were seriously interested in suggesting improvements or in learning more about their city. The unruly dissenters were few.

Assistant City Manager Esser makes the following suggestions to other cities which are interested in holding similar public forums:

1. Give the meetings the widest possible publicity, using all available media.
2. Select well-known meeting sites, such as school auditoriums, and be sure there is sufficient seating. Provide public address systems so that everyone may be heard.
3. Use pre-submitted questions to get the discussion rolling.
4. Spend some time studying the major problems of the particular area involved in order that department heads may prepare answers to likely questions and draw up any necessary charts or other graphic presentations.
5. Attempt to give the best answer possible to questions and elaborate on those problems common to the greatest number of people.
6. Double check to insure that any promised corrective action is taken promptly.

Members of the Phoenix city administration are happy with the reaction to the "Know Your City" meetings. Typical was this editorial comment in the Arizona Republic, Arizona's largest newspaper:

"These meetings are not only democracy in action, but a very practical means of presenting pleas for improvement or for requesting explanations of past city actions. Like the "voter" who doesn't vote, the resident who doesn't take advantage of such meetings is cutting himself out of a voice in local government."

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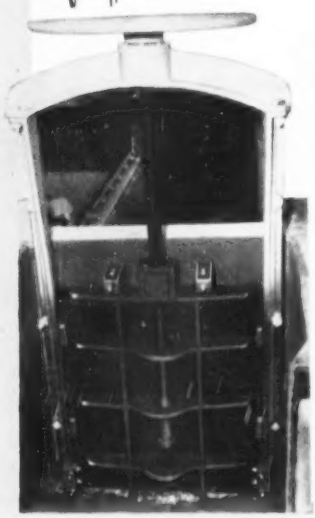

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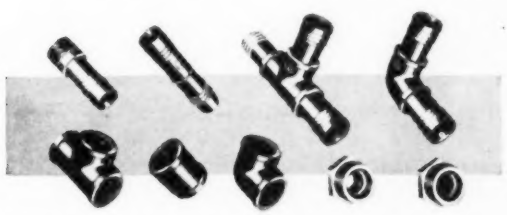

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economical procedure could be developed. The League of California Cities was instrumental in obtaining research funds, and work got underway late in 1949 with a study of the literature.

Foreign Processes

The extensive composting operations of Holland (some 160,000 tons of compost per year) are based upon the utilization of a raw material from which most of the vegetable matter had been salvaged for animal food. The remaining refuse, street sweepings, and ashes compost well, but require a relatively long period of time because of the low nitrogen content. The procedure used would result in an objectionable odor if applied to the mixed garbage and rubbish from American cities.

The Dano Process in Denmark could be used to prepare our refuse for composting, but the methods of composting, largely by the farmers themselves, are not suited to the habits of American farmers.

The Becari and Verdier processes used in Italy and France involve expensive equipment and license fees, an obsolescent anaerobic-aerobic process, and a history of preliminary failure in the United States which made them unacceptable to our municipalities.

The Indore Process of India and South Africa is inapplicable to our conditions because it uses night soil, animal manures and hand labor. Work in Australia and New Zealand is tentative and concerned with miscellaneous organic composts for increasing soil fertility.

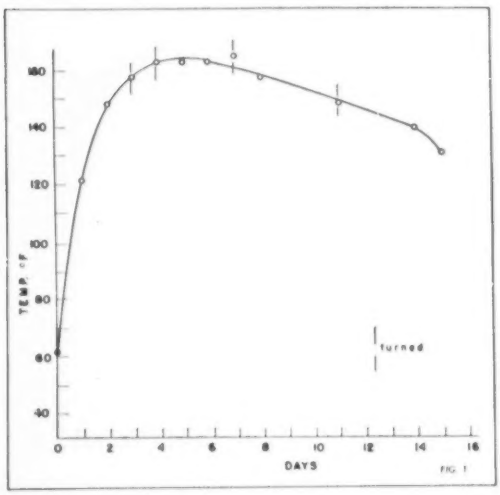
In the United States composting has involved a confusion of unfounded claims of questionable scientific merit. Factors held by various proponents to be essential included inoculation with special organisms, seeding with manure or partially decomposed organic matter, recirculation of liquids and gases, forced aeration, and addition of enzymes and hormones. Attempts to commercialize the process have been directed toward the sale of

POSSIBILITIES OF COMPOSTING MUNICIPAL REFUSE

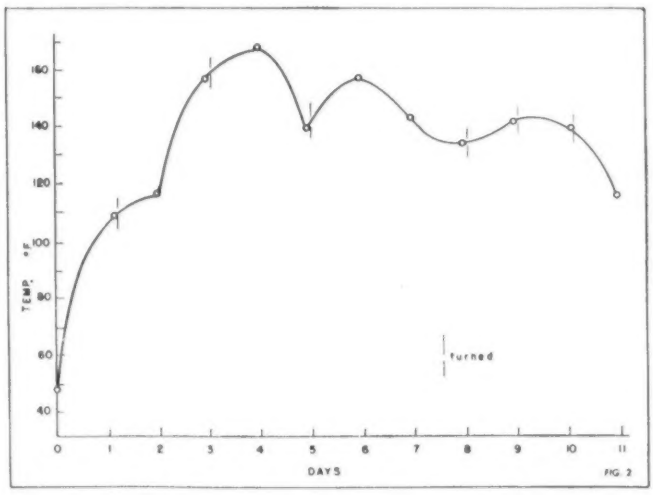
P. H. McGAUHEY,
Assistant Director,
C. C. GOLUEKE,
Mycologist,
Sanitary Engineering Research Project,
University of California

IN California there is an urgent need for both reclamation of garbage and its disposal. Large-scale farming of heavy or formerly arid soils, both of which need organic matter, is fundamental to the State's prosperity. The explosive growth of population has taxed the capacity of existing sites for refuse disposal by landfill; smog has caused a re-examination of incineration as a universally applicable method; and higher standards of sanitation and public health are producing public dissatisfaction with many refuse handling practices.

Professor Harold B. Gotaas of the University of California was among the first to recognize that California's problems were such that reclamation by composting should be a logical solution if a rapid, esthetically acceptable, reliable, and



● **CHARACTERISTIC** curve of temperature during aerobic composting shows steady bacterial action.



● **CURVE** showing erratic course of temperature in a small compost pile under partially anaerobic conditions. Turning aerates the pile.

patented materials rather than to the production and sale of compost. It was therefore necessary to develop a sound procedure for the composting of municipal refuse. The procedure was then tested and refined in a field study in cooperation with the City of Berkeley. In this study municipal refuse of a wide variety of characteristics was composted, both alone and in combinations with raw or digested sewage sludge, and cannery wastes.

As a result of this research program it is possible to set forth the fundamentals of a method of rapid composting of municipal refuse, and to establish the principal economic and design factors involved.

Fundamentals and Controls

The composting process recommended is one in which, under suitable environmental conditions of aeration and moisture, thermophilic aerobic micro-organisms reduce organic matter to a fairly stable humus, quickly and without nuisance. It is essentially a problem of materials handling under relatively simple controls.

The fundamental steps include segregation, grinding, stacking in windrows or piles, aeration by turning, and regrinding. The course of the process and the time required are determined by moisture content, aeration and the ratio of carbon to nitrogen. Controls include moisture adjustment and frequency of turning, and require a knowledge of how to judge the condition of compost by temperature, odor, color, physical appearance, and certain laboratory tests.

Segregation of Refuse.—Grinding of the raw material is one of the essential steps in aerobic composting, hence some degree of segregation of municipal refuse seems unavoidable. In cities using separate containers, the responsibility for segregating refuse might be imposed upon the individual householder, but it is unlikely that compliance would be perfect. In cities presently using combined collection it would be difficult to institute the use of multiple containers. Therefore, if composting is to become an accepted method for treating municipal refuse, necessary segregation of the ordinary components of refuse must be done by the disposal agency.

Materials which would normally require removal before the grinding constitute about one-third of the total weight of refuse. They include tin cans, miscellaneous metals, glass, and ceramic ware. Under certain conditions excess paper might be removed to decrease the carbon-nitrogen ratio of the material. Rags are generally removed because of their high salvage value, being picked by hand from a conveyor belt, as are valuable non-ferrous metal objects. Tin cans and other ferrous metals are commonly removed by a magnetic separator. They may or may not pay the cost

of salvage. Berkeley experience indicates that some sort of beater is necessary to break open bags of refuse which might contain objects harmful to the grinder. If excess paper is removed, it can be taken up by a blower with its suction directly over the conveyor belt. Bottles, glass, and ceramic objects are the most difficult to deal with. Hand picking is an unprofitable undertaking, and pulverizing glass mixed with garbage introduces difficult problems in equipment.

Grinding of Refuse.—Grinding or shredding of refuse produces a number of beneficial results which hasten decomposition. The material is rendered more susceptible to bacterial invasion, made quite homogenous, and given a beneficial initial aeration. It acquires a structure which facilitates handling and increases its response to moisture control and aeration. None of these characteristics are adversely affected by ground glass, but such material increases the already phenomenal abrasiveness of refuse. Mills capable of pulverizing difficult objects like the bottom of coca cola bottles are available, but they are not suited to the grinding of garbage in the same operation.. Equipment used in Europe has been somewhat more successful in this matter. A mill used by the VAM in Holland involves a device like a rimless wheel with U-section spokes. Glass not pulverized is thrown out centrifugally and separated from the organic material to be composted.

In the Berkeley studies a Type EMV Enterprise hammermill did a satisfactory job of grinding segregated refuse. With modifications to increase feed capacity and with development of hammers suited to abrasive refuse it could be adapted to grinding municipal refuse on a production scale, and possibly could reduce glass to particles not objectionable in compost which is to be sold in bulk for field use.

The aim of grinding is to chop refuse into small pieces. There is no special size requirements but the material must not be pulped lest it become too soggy to compost. If a hammermill is used, as in the Berkeley Studies, a $1\frac{1}{2}$-inch screen opening should be about the minimum. If shredding is employed, pieces about 1 inch in size are to be recommended.

Stacking of Refuse for Composting.—Ground refuse may be stacked directly on well drained soil or on pavement. Windrows of a trapezoidal cross-section are most convenient. In wet weather the top may be rounded to shed rain. In rainy climates, a shed roof may be necessary because continual rain will soak a compost pile, causing it to become anaerobic and requiring a long time to compost. Windrows might initially be made 8 or 10 feet wide at the base, being rebuilt on turning to narrower piles as shrinkage occurs. The maximum height should probably not exceed 5 or 6 feet or the material will be compacted by its own weight and require excessive turning to prevent or overcome anaerobic conditions. Excessive temperature (above 160 to 170°F) may develop in a thick pile producing a thermal kill of organisms. A minimum of 4 feet is recommended lest heat loss be excessive and the active internal volume be small in comparison to the less active surface, thus increasing composting time. Other than height, there is nothing critical about windrow dimensions and experience with equipment used in handling would soon establish the best practice.

Turning.—The principal reason for turning is to provide the aeration essential to the rapid, odor-free composting that characterizes aerobic decomposition. Uniform decomposition results from turning the outer material into the center at each turn. In this manner any fly larvae, insect eggs, or pathogens which might survive at the cooler surface are exposed to the lethal temperature (above 140°F) of the interior of the pile. Turning

must, therefore, accomplish an inward mixing.

Turning is also the best method of reducing the initial moisture content to prevent anaerobic conditions, and will reclaim a pile that has become anaerobic. The initial moisture content for best composting is 40 to 60 percent. This must be determined by an analysis, which can be done with sufficient accuracy in any oven at about 215°F. Above 70 percent moisture, aerobic conditions cannot be maintained, and below 30 percent there is too little moisture for biological activity. A recommended turning schedule is as follows:

If initial moisture is less than 70 percent, the first turn should be made on the third day. Thereafter turn as follows until the 11th or 12th day: Moisture, 60-70%: Turn at 2-day intervals; 5 turns required. Moisture, 40-60%: Turn at 3-day intervals; 4 turns required. Moisture, less than 40%: Add moisture by spraying pile during turning, then follow normal schedule. Moisture, more than 70%: Turn daily until moisture is reduced below 70%, then follow normal schedule.

A good rule of thumb is to turn every day when a foul odor is evident and continue that schedule until the odor disappears.

Turning equipment is not yet developed but could be done by a special dozer attachment, a modified overcab loader, or a special machine similar in principle to a modern snow plow.

Final Grinding.—For the sake of appearance, compost is reground either when finished or near the end of the active stage—the 10th or 12th day in dry weather. Regrinding during the latter part of the active stage may take the place of the final turning as the material will then finish with no more turns, provided the moisture content is above 40 percent. Additional cost, however, is involved in transporting material to the grinder and back to the pile, since material reground before the process is complete should be allowed to finish composting before being placed in stacks. Reground finished compost may be stockpiled in high stacks without further attention.

Regrinding may be done in the same mill used for initial grinding, provision being made for producing smaller particles. In the Berkeley studies, material with a moisture content of 55 percent was reground without any difficulties in the hammermill equipped with a $^3/_8$-inch screen. For municipal refuse the $^3/_8$-inch screen opening was found to be the most satisfactory size.

The Course of Composting

As previously mentioned grinding promotes bacterial invasion of organic matter, makes the refuse homogenous and gives enough aeration for the first 3 days if moisture is between 40 and 60 percent. Berkeley studies indicate that initial moisture of ground municipal refuse will fall within this range. If moisture is higher, due to rainfall or other conditions, daily turning is cheaper than adding straw or soil. Paper is a poor device for controlling moisture.

Bacteria indigenous to refuse go to work rapidly. Mesophilic organisms flourish until temperature is too high for them; then thermophiles develop and eventually take over, pushing the temperature to 140° to 160°F. in a continuous rise during about 48 hours. Thereafter a high temperature pertains for a few days, then drops off as the composting period nears an end. At the final lower temperatures, actinomycetes flourish. They seem to be

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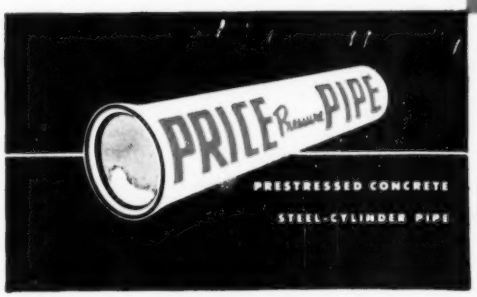

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the most effective organisms in breaking down paper. The compost may be considered finished when the temperature gets down to 130 or 120°F, but this is not alone a sufficient criterion.

The time required for composting at a normal moisture content (40 to 60 percent) depends on the C/N ratio. At a C/N ratio of 20 to 50 normally found in mixed municipal refuse, about 16 days were required at Berkeley. With a C/N ratio of 78, 26 days were required; at C/N of 20, only 14 days. Table 1 shows typical composting times reported by various aerobic and anaerobic methods.

TABLE 1—TYPICAL COMPOSTING TIMES

Material	*Reported By*	*Time*	*Conditions*
Mixed Municipal Refuse	U. of Calif.	2 - 3 weeks	Field
Garbage plus straw	" " "	5 - 9 days	Pilot Plant
Garbage plus manure	" " "	5 - 9 days	" "
Garbage plus sewage sludge	" " "	14 - 16 days	Field
Garbage plus sewage sludge	Frazer, N. Y.	7 days	Production Field
Mixed Municipal Garbage, etc.	Dannevirke, N.Z.	20 - 30 wks.	Field
Air dry refuse and Night Soil, etc.	Fricksburg, S. Africa	30 days in pit "ripen" 4-6 wks	Field
Selected refuse and Sewage Sludge	Domfriesshire Gr. Britain	6 wks composting 6 wks maturation	Field
Grass Clippings	U. of Calif.	11 - 14 days	Pilot

Judging Condition of Compost.—A compost is considered finished when it can be stored indefinitely without generating appreciable heat, and can safely be put on agricultural soils because of its low C/N ratio, (20 or less); or if more than 20, the carbon is in an unavailable form. This and foregoing considerations involving C/N ratio means that laboratory tests must be made. Nitrogen is easily determined, but a carbon determination is tedious and expensive. Carbon may be calculated by an empirical formula suggested by New Zealand researchers. C = (100 − % ash) ÷ 1.8. This gives results sufficiently accurate for practical composting.

Characteristic changes in color and odor are aids in judging the course of a compost. Grinding alone serves to replace the sour greasy odor of raw garbage with an odor generally associated with freshly cut green vegetable matter. As the temperature increases, cooking odors are evident, but they gradually decrease as decomposition progresses. A slight odor of ammonia may persist during much of the composting period and become quite pronounced in a compost which is losing nitrogen. Nitrogen is lost during composting in increasing amounts as the C/N ratio decreases below about 30.

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by the development of foul putrefactive odors and a sickly green color instead of the normal brown or dark color inside the pile. Finished compost may have no odor, a slightly earthy odor, or the musty odor of molds.

Value of Compost

Finished compost is more valuable as a soil conditioner than as a fertilizer. By improving soil structure it increases the water retention capacity, and encourages more extensive development of root systems of plants. It makes inorganic phosphate more readily available to higher plants, and by converting nitrogen to a less soluble form allows it to be released gradually instead of being leached away. It is a valuable source of nutrients, including the essential trace elements. For example, the fertilizer value of compost produced at Berkeley averaged: Nitrogen, 1.18%; phosphorous pentoxide, 1.33%; potassium oxide, 0.99%.

Composting has not yet been put on a commercial basis in the United States on a municipal scale. Pilot studies and limited experience have indicated the nature of needed equipment development and have established some premilinary concepts of the costs involved. With varying degrees of certainty a number of general things may be said of the cost of municipal composting.

1. In spite of the enthusiasm of many proponents of composting, it is doubtful that it will make refuse collection and disposal economically painless to citizens. Municipal officials should recognize that it costs considerable to collect and dispose of refuse, and this will probably continue to be the case.

2. An experienced engineer can lay out the necessary plant for receiving, segregating, grinding, stacking, and regrinding and storing the product. He can determine the land use and similar factors, and suggest ideas for special equipment involved. Some items of cost will remain problematical until actual composting plants are in operation.

3. The cost of segregation of refuse for composting will not be appreciably lessened by salvage.

4. Grinding and turning equipment must be further developed before its cost can be stated with any degree of accuracy. It may be estimated on the basis of current costs of various types of mills and materials handling equipment.

5. Production costs of composting selected garbage with sewage sludge by the Frazer Process are reported to be $15 to $20 per ton.

6. Preliminary estimates based on the use of the Dano grinder in the United States show $9 to $10 per ton of raw refuse, or about $15 per ton of finished compost.

7. Rough estimates based on proposed modification of American grinding equipment indicate that it should be possible to reduce production costs somewhat below $15 per ton as practical composting of municipal refuse develops.

8. The composting of refuse together with raw sewage sludge and certain trade wastes could conceivably lower the present overall costs to a community for getting rid of its waste products.

The commercial value of finished compost is more uncertain than the cost of production. Nevertheless, some general considerations can be presented.

1. The cost of converting compost to a legal fertilizer is such that a municipally owned operation might

(Continued on page 160)

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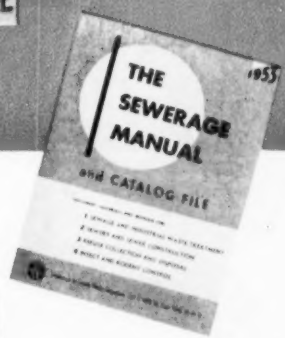

This year it is estimated that close to 400 million dollars will be spent *in new construction alone* for sewage and refuse disposal, rural sanitation and industrial waste treatment. No small responsibility. How can you be sure you're getting the best and the most for the taxpayer's dollar . . . that there isn't some short cut you've overlooked . . . some better way of tackling a problem?

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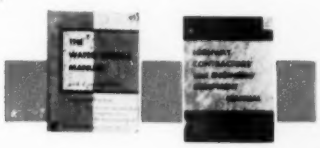
Put these to work, too:



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This Sno-Plow has two shock absorbing connections between the moldboard and Drive Frame Assembly so that the cutting edge springs up and back when an obstruction is encountered. The cutting edge immediately returns to working position as soon as the obstruction is passed. This cutting edge is reversible to provide double wear.

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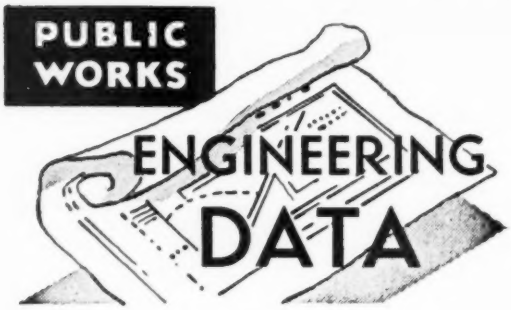

Service Behavior of Calcium Chloride Treated Gravel Roads

Calcium-chloride-treated gravel roads in Onondaga County, N. Y., over a 16-year period show a gravel loss of only 23.5 cu. yd. per mi. per yr. for roads carrying from 41 to 216 vehicles per day. Comparing this loss with those reported by the University of Michigan and others for untreated gravel roads, it appears logical to assume a saving of at least 50 cu. yd. of gravel per mi. per yr. by maintenance with calcium chloride.

Of much greater importance from the standpoint of economy is the fact that there also is a decided saving in annual blading costs. H. A. Radzikowski, chairman, Highway Research Board Project on Maintenance, discussed blading costs on soil aggregate roads in Bulletin 29, HRB, following an analysis of maintenance in six areas in six states. He reported that some roads were bladed as many as 160 times, and that the cost per operation ran as high as $7.25 per mi.

"It is estimated that our blading costs average about $9 per mi. using a Diesel-powered grader at a rental charge of $33.60 per day and an operator at $12 per day of 8 hrs.

"Assuming that it would be necessary to blade our roads about once a week between May and November if they were not treated with calcium chloride, this would mean 25 to 30 bladings as compared with our present schedule of three to four bladings. On the basis of an annual saving of 25 bladings at $9 each, and a saving of 50 cu. yd. of gravel at $1 per cu. yd. on the road, there is a saving of $275 per mi. per yr. in favor of calcium chloride treated gravel as compared with untreated gravel roads. This saving more than offsets our present treating costs of approximately $210 per mile per year.

"In addition to the economic factor, our calcium chloride treated roads are stable in all kinds of weather, and at similar driving speeds provide a degree of security and safety equal to that provided by other type surfaces. The motorists using these roads, as well as the residents, are satisfied with this type of surface. When conditions warrant improvement, these roads serve as excellent bases for bituminous or concrete wearing surfaces, as has been the case with some 300 mi. of similar roads in Onondaga County which have been surface treated during the past 10 or 12 years."

This summary of a report to the Highway Research Board by E. M. Baylard, Superintendent of Highways, Onondaga County, New York, appeared in "Dowflakes."

CUT RESURFACING COSTS— USE WB "MANHOLE ADAPTER"

A resurfacing technique—meeting new grades —without trouble and expense of raising manholes.

On the job in Kansas City—workman aligns WB "Manhole Adapter" in place with allen studs. Note outside compaction flange and seat provided for original cover plate.

WB "Manhole Adapters"* allow a single crew to adjust up to 24 manhole covers per day. Compare this high daily rate to only three or four complete manhole rings raised by the old method. It's a saving up to 80% in costly time and labor. In addition, street and manhole structural strength is maintained. Traffic hazards are reduced to a minimum — streets are open during resurfacing operations — no need for lights and barricades — no traffic tieups.

WB "Manhole Adapters" are tailor-made to fit all street openings and varying elevations—water and utility boxes as well as surface drains. Features include compaction flange, tripod rest and aligning studs — economical, safe and structurally sound.

Held above is the WB "Water Box Adapter" which should have been used here to eliminate needless digging and traffic hazards. Labor and expense could have been saved. The structural strength of the street would not have been impaired.

Get more "mileage" for your street resurfacing dollars. Use WB "Manhole Adapters," accepted by the engineering profession and now serving such representative cities as Canton and Dayton, Ohio; Chicago, Ill.; Dearborn, Mich.; Kansas City, St. Joseph and St. Louis, Mo.; Rochester, N. Y.; and Trenton, N. J.

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The air placed concrete formed a solid bond to old concrete so dense that further water seepage, freezing and subsequent crumbling were stopped.

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We'll be there . . . at the 1953 Public Works Congress and Equipment Show in New Orleans, October 26 to 29. See us in Booth No. B-11. We'll show you the Models #750 and #1250 BONDACTORS and our new MIX-ELVATOR—portable concrete elevator, mixer, proportioner, blender, feeder — automatic, continuous!

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Laying a Mile of Six-Lane Hot-Top a Week

Massachusetts opened to traffic last fall the 14-mile stretch of the Boston-Fall River Expressway between Fall River and Route 14. It has two 34-ft., 3-lane surfaces separated by a depressed median 20 ft. wide. A 4½ in. penetration macadam base rests on a 12-in. compacted gravel subbase, and is surfaced with 2½ in. of hot-mix bituminous concrete. The last was laid in quick time, considering the average haul was 16 miles—5½ miles of two-course 6-lane pavement, total width 68-ft. in 38 working days. A Barber-Greene finisher was fed almost continuously from five 20-ton Fruehauf trailers and six 12-ton Sterling trucks. Over 1,000 tons were laid every day, 6 days a week, in two 1¼ in. courses. Both courses were compacted with two rollers—a 12-ton tandem for the first passes, followed by a 15-ton 3-wheel unit. The top course contained 42% sand and 6.5% bitumen; the binder course, 26% sand and 5% bitumen.

"Flexible Pavement for Divided Highway;" *Contractors and Engineers*, June.

Determining Density Of Granular Bases

The Road Research Board of the Dept. of Scientific and Industrial Research (England) has developed a method of determining the density of bases or subbases composed of crushed stone, slag or other granular materials. Because the size of these may be as great as 3-in., the standard method of sand replacement in a hole 4 in. in diameter is impracticable, the smallest hole that can be dug in such material being about 8 in. and the depth also may need to be 8 in. It was desired that the method provide reproducibility of the measurement, and determination of the error in the average volume. The former is effected by reproducing a duplicate of the hole. The hole is filled with plaster-of-Paris, and from this as a mould, an aluminum casting was made and used to check the accuracy and reproducibility of several methods of determining the volume of the hole itself. The materials used varied from fine sand to ¼ to ⅛ in. well rounded gravel; and the results (averaging 20 tests of each) of all had the same accuracy, but the variations increased with the particle size. It is important that the filling material be perfectly dry. At least 10 measurements should be made, and the average will probably be within 1½%.

"Determination of the Dry Density of Compacted Layers of Coarse, Granular Materials;" by L. West, Road Research Laboratory. *The Surveyor* (England), August 8.

The Moroccan Air Base Pavements

The five air bases which the U. S. is building in French Morocco and which were so severely criticized a few months ago, were examined closely and thoroughly by the editor of Engineering News-Record to learn their present condition. He reports that they will be among the best and most efficient of such setups in the world. There were defective places, due to the urgency for speed to prepare them for a threatened war; but these are now being repaired so effectively that they will be the best areas in the entire base. In three of the estimated five months, the contractors handled as much rock, did twice as much excavation and put down 1½ times as much asphalt paving on the first two airbases as had been scheduled for all five. At Sidi Slimane, where the worst defective pavement was found, these were due to clay pockets in the base material, lack of thorough compaction, and an initially high watertable. The bad spots were located by subjecting the entire area to 24 passes of a 200-ton compactor. Areas that do not exhibit obvious springiness under load or a slow rebound after it passes are considered satisfactory. Where ruts, depressions or heaves occur causing deflection from a 3-ft. straight edge of more than ⅜ in. the pavement is cut out and removed by a carrying scraper or elevating loader. The surface and old base are removed, and generally the subbase also. The best of selected materials are used in replacing the subbase and a CBR of 35 to 50 is obtained in the first course by rolling with a 200-ton compactor.

Then two 3-in. courses of subbase are compacted to 80-100 CBR. A 1½ to 2-in. binder course of asphaltic concrete brings the surface flush with the unrepaired area. After all repairs have been made, the entire runway, main taxiway and apron will be paved with a new 2-in. surface of asphaltic concrete.

"Aftermath in Morocco—Good Airbases;" by Waldo G. Bowman, Editor, *Engineering News-Record*, August 27.

Asphalt on Soil-Cement for Air Base

In building the 750,000 sq. yd. of roads and streets at Edwards Air Force Base, Calif., in the Mojave Desert, the engineers decided on a surface of 2½ in. of hot-mixed, dense-graded asphaltic concrete on a stabilized base. For the latter, alternate bids on both soil-cement and stabilized aggregate were obtained on the first of two major contracts. The bids for the former were very much lower, due to the difficulty of obtaining good aggregate. In constructing the soil-cement-stabilized base, the cement content varies between 5.5 and 8% by volume, depending on the soil. The cement is deposited in win-

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Keokuk County's tough No. 12 spreads stone on a county road in preparation for winter.

Keokuk County, Iowa, has a Cat* No. 12 Motor Grader that has been stationed in Keota township since 1945. It maintains 90 to 100 miles of roads, covering them once a week in summer, clearing snow in winter. And in more than 12,000 hours of steady work, the cylinder head has never been off the engine!

If you've got a grader with that much trouble-free operation, we'll bet it's Caterpillar-built.

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5. It gets the job ready for an early spring start, and has the power and traction to tackle thaws and mud.

Prepare for winter now by seeing your Caterpillar Dealer. He'll prove by an on-the-job demonstration that you'll get more months of work out of these tough, durable machines. And he'll back their long life with genuine parts and reliable service.

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drows by a traveling distributor, to the rear of which is attached a spreading mechanism; adjustments of which permit applying a specified amount per foot of travel. A mixing machine applies 8 to 11% of water as it picks up the material, and is followed closely by motor graders. Both three-wheel and rubber-tired rollers are used for compaction. The curing coat is not applied until laboratory analyses have been made, which takes about 45 minutes. It is an asphalt emulsion heated to 125° and spread at the rate of 0.18 gal. per sq. yd. and is kept free of traffic until the asphalt concrete has been laid. This base cost 24.3 ct. per sq. yd. by the first contract and 17 ct. by the second.

"Asphalt and Soil-Cement Team for High-Type Air Base Roads." *Engineering News-Record*, Sept. 3.

Highway Studies From Aerial Photographs

Although the use of aerial photographs in highway studies is becoming standard practice in most state highway organizations, many engineers are still not familiar with the methods of obtaining such information to produce comprehensive engineering studies, and this article explains the methods and points out some of their applications and limitations to highway studies. The method used most frequently by engineers is photo reading. Photo interpretation requires special background and training. Photogrammetry is very important in highway studies; it requires technical training and special plotting instruments. Photo reading and photo interpretation can be applied to reconnaisance and preliminary highway studies. Photo reading is mainly applicable to studies of alignment, right-of-way, land use, and watersheds. Photo interpretation is applicable to an evaluation of soil-parent material areas, location of possible borrow materials, and adjustments in alignment to avoid poor soil. Photogrammetry can be applied to preliminary highway location studies and also, with certain limitations, to final location surveys. Topographic maps at 2- or 5-ft. contour intervals prepared by standard photogrammetric methods cover a much wider band of terrain than it is feasible to secure by ordinary field surveys. The author describes in some detail the use of each of these methods.

"Highway Studies From Aerial Photographs;" by Robert D. Miles, Instructor in H'way Engr., Purdue Univ. *PUBLIC WORKS*, September.

Soil-Cement On a Sandy Site

A 32-acre soil-cement parking lot on President's Island near Memphis, Tenn., was constructed during last winter on a coarse, dry sand which afforded little traction for rubber-tired vehicles. The contract was let toward the end of November, work began Jan. 7, continued during rainy and freezing weather, and the last bituminous curing material was placed during the first week in April. Ten acres of the land was on a 12% slope, where cement hauling and spreading equipment had to be pulled by crawler tractors because of the coarse, dry sand. On the level area, some rubber tired vehicles were practicable if the sand was kept wet, which was effected by means of a high-capacity pump. But even then the bulk-cement dump trucks bogged down, until the contractor mounted dump bodies on army surplus half-track trucks for this purpose. In the case of the cement spreader, the axle was re-

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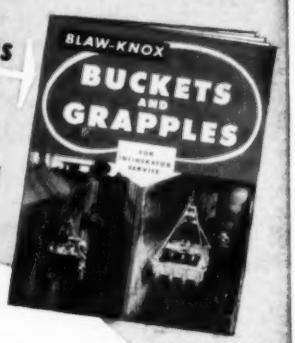

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HANDLING CALLS from irate voters after winter storms are real headaches. And straightening-out traffic tangles takes up lots of time. Here's where Hi-Way's Ice Control Method fits into your picture. It's simple . . . it's inexpensive . . . it makes year 'round good sense!

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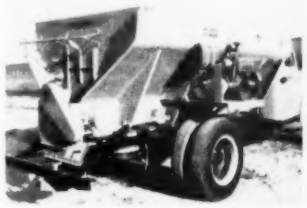
You'll find that Hi-Way Spreading Equipment does your job faster . . . making more miles of highways and streets safer per hour. They perform at speeds up to 35 MPH., spreading uniformly at any in-between-speeds.

When storm forecasts come in, your trucks can be ready-loaded for action. All you need do is call out the driver. And best of all, Hi-Way equipment is versatile. There's no summer idle period. It can be equally as efficient for seal coating, road stabilization and dust control with sand, stone, chips, rock salt or calcium chloride.

Your job will be easier with Hi-Way . . . the results more satisfying . . . the cost less . . . with added safety. Irate voters become happy voters, impressed with your good judgment.



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placed with a longer one, on each end of which was attached a drum with cleats, much like paddle wheels.

After the site had been brought to grade and the cement spread, the cement and soil were mixed with a traveling mixer, which added water and spread the mixture in an even layer. Initial compaction was effected by several trips of a Caterpillar tractor, which was followed by a pneumatic tire roller, this by a spiketooth harrow and final rolling with the pneumatic tire roller. The soil hardened slowly and it was necessary to water cure the soil-cement for about 48 hr. before an asphalt distributor could be used without marring the surface.

"32-Acre Soil Cement Parking Lot." *Roads and Streets*, August.

Lowering High Beams

The Connecticut Highway Dept. finds that the accumulation on shoulders of dirt and winter-applied sand gives continuing trouble to the maintenance forces, and has developed mechanism for fast, positive and economical removal of the accumulations on embankments where the presence of a guard rail prevents use of ordinary scrapers. An I-beam is attached across the front end of a truck, and on this a 7-ft. H-beam slides back and forth laterally, activated by a hydraulic cylinder, utilizing the power used for raising a snow-plow wing attachment. A 4-ft. scraper blade set at an angle on the end of the H-beam pushes the dirt into a windrow under the guard rail. Then a 5-ft. scraper blade is mounted at right angles to the end of the H-beam and pushes this windrow and the remaining ridged material laterally to the edge of the embankment. It can process about 3500 lin. ft. of berm in an 8-hour day.

"Built-up Berm Shaved by Scraper Device." *Better Roads*, July.

Skidding and Psychology

The report for 1952 of the Road Research Board of England, in discussing skidding, states that the newer cars, with their more efficient braking systems, are more prone to skidding on wet roads than older cars; also that skidding on wet roads is far more frequent in summer than in winter. The English weekly, "*Highways and Bridges*, commenting on this, suggests that the reasons for these may be partly psychological—that many drivers of modern cars trust far too much to their braking power and that high efficiency brakes can be positively dangerous if applied violently in an emergency. Also that the more frequent skidding on wet roads in summer than in winter is partly because drivers are accustomed to higher speeds in summer, since the roads then are dryer and frost is entirely absent; while in winter, mindful of the dangers of frost and ice on the roads, they are cautious about accelerating and braking. The influence of temperature in varying the viscosity of water films the commentator considers to be "scientifically intriguing."

"Road Research, 1952." *Highways and Bridges*, August 26.

A Grading System For Evaluating Roads

A grading system has been developed in Portage County, Ohio, for evaluating a system of roads to learn their comparative conditions. Eleven headings are used. Under each heading, 6 is the maximum

The NETCO CATCH BASIN CLEANER
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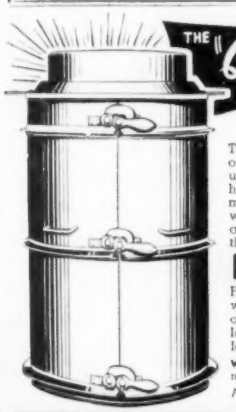

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score, and a combined score of 66 is a perfect one; a score of 40 is considered to indicate a road in tolerable condition. The heads, and the conditions to which a perfect score of 6 is applied, are as follows: Width of right-of-way, 60 ft. or more. Width of pavement, more than 20 ft. Roadside drainage, "very good." Traffic count, "less than 50 vehicles". Structures, "capable of carrying legal load and wide." Maintenance costs, "below average." Horizontal alignment, "very good." Vertical sight distance, "very good." Accident frequency, "below average." Safe driving speed, "50 mph or more." Use by commercial trucks, "light truck traffic." The lowest rating under the individual heads varies from 0 to 3, the former for Roadside drainage, Maintenance cost, Horizontal alignment, Vertical sight distance, Accident frequency, and Safe driving speed.

'Chart Indicates When a Road Is in Tolerable Condition;" by Paul C. Shafer, County Engr. *Better Roads*, July.

• • •

New Street Patching Policy

A new street patching policy has been established in San Diego, California. Now crews of workmen patrol city streets locating needed street repairs. Formerly the city's public works department waited until complaints were received before dispatching workmen.

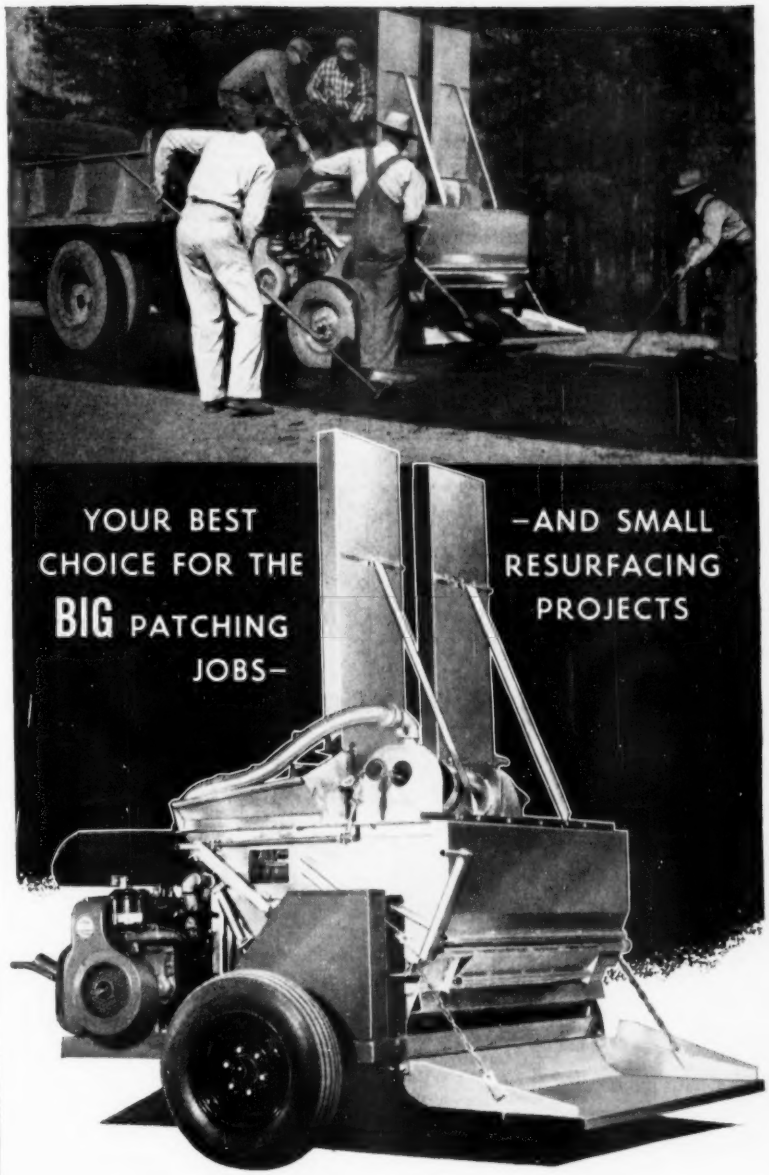
Since the system was established three months ago, public works department officials say work is better systematized and frequently can be performed at less cost because it is undertaken before repairs are serious. More important, they feel that work is performed according to actual need — rather than to complaints.—From *Ohio Cities and Villages*.

• • •

Leo Ritter

(*Continued from page* 14)

were built from 10 to 14 years ago with a wide range of variables and afforded an excellent comparison between the behavior of air-entrained concrete sections and sections of the same construction but without air entrainment. The sections have been subjected to severe exposure under repeated cycles of freezing and thawing and salt action in ice removal. No scaling or disintegration has occurred on any of the air-entrained concrete sections included in the study. However, in



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In any season . . . under wet or dry conditions . . . this new McConnaughay HTD-LP Mixer can assure you the fastest, most economical production of bituminous paving mixtures (hot or cold) for big patching jobs, small resurfacing projects, driveways and parking areas. Working right on location, it provides the exact amount of paving material needed . . . never too much or too little. With mixer and heating unit combined, it will reactivate and heat up to 20 tons of stock pile mixture per hour, prepare up to 8 tons of hot or 18 tons of cold asphaltic mixtures per hour, dry various types of wet aggregates quickly, remove both moisture and solvents from bituminous mixtures. Other features include low pressure burner, blower for fuel atomization, stacks for removal of gases, 6 cubic foot mixer capacity. Write, wire or 'phone for details and specifications.

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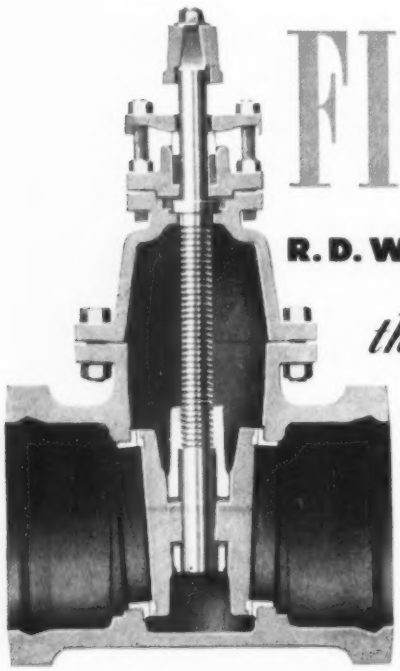
many sections which used cement from the same mill, but without air-entrainment, up to 100 percent scaling has taken place.

Shoulder Maintenance—The August issue of the Calcium Chloride Institute News featured an interesting article on shoulder maintenance by B. R. Downey, Maintenance Engineer of the Michigan State Highway Department. Mr. Downey's remarks about the maintenance of stabilized aggregate shoulders were of particular interest to this reader. An interesting piece of equipment—the "shoulder maintainer"—is used in these operations. The maintainer is a combination unit which consists of a short cutting blade, a strike off blade with an edger which is mounted directly behind the wheels of the maintainer, and a towed six-wheel rubber-tire roller. The stabilized gravel shoulder is bladed after a rain or sprinkling. The strike off blade and edger are set to sweep the excess shoulder material back on the shoulder, thus keeping the roadway clean and free of excess material. The roller compacts the loose material after it has been shaped by the blade.

Maintenance by Contract—We have previously discussed the increasing use of contact maintenance by many government agencies. A clear-cut statement of the advantages which have accompanied the use of contact maintenance by the New Mexico Highway Department as a planned part of their overall maintenance program is contained in a paper by I. B. Miller, Chief Maintenance Engineer. The paper appears in the Proceedings of the 26th Annual Highway Conference of the University of Colorado, recently published. Mr. Miller's statements are, in part, as follows: "The use of contract maintenance permitted (1) the Department to stabilize its labor force at a given size; (2) a decrease in the capital outlay for equipment; (3) to some extent a decrease in unit prices for both contract construction and maintenance, inasmuch as contractors were able to operate more efficiently with the increased work load; and (4) field engineering construction forces, which supervised maintenance contracts, to become familiar with maintenance problems and pointed out to them construction practices which resulted in increased maintenance costs."

It Won't Be Long Now — Since this is being written at the tail end of the most trying heat wave of the year, it's a little difficult to think about snow removal and ice control. Nonetheless, winter is on its way and now is the time to double-check and make absolutely certain that men, materials and equipment are ready. From a sideline quarterback's view, let's keep on top of the situation this year.

Miscellany — Latest reports are that nothing will be done about the proposed AASHO test road in Illinois until after the national convention in Pittsburgh next month. Don't be too surprised if the whole thing is shelved. We ought to know a lot about concrete pavements one of these days, since PCA has a tremendous study underway at its labs is Skokie, Illinois and the Navy has one going at Port Hueneme, California. Despite all the efforts which have been made to sell the highway program, increased gasoline taxes were approved by the legislatures of only 5 states this year, although 27 such proposals were made. Authorities have estimated that state backing of the bonds sold for the construction of the Garden State Parkway in New Jersey meant a saving of $3 million per year in financing costs.



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PUBLIC WORKS DIGESTS

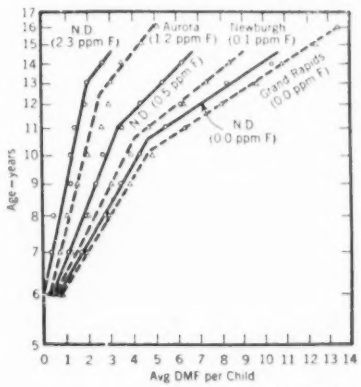
THE WATER WORKS DIGEST

Fluoridation of Municipal Water Supplies

Various phases of this subject were presented in five papers appearing in the August issue of the Journal of the AWWA. The amount of attention paid to this subject seems justified by the rapid growth of the practice. The Committee on Fluoridation Materials and Methods reports that by the end of 1952, in the United States 12,590,292 persons were drinking fluoridated water; and the USPHS estimates that, as of May 15, 1953, 409 water works were delivering fluoridated water to 14,350,000 people in 777 communities. In addition, 357 communities with a total population of 15,800,000, had approved it. During 1952, 182 water systems, serving 447 communities in 6 states, which contained 8,180,213 population, were added to the list; thus doubling the number of systems and tripling the population served at the beginning of that year. The only states reporting no plants practicing fluoridation were Arizona, Missouri, Nevada, New Mexico, and Utah.

Five chemicals were reported in use: sodium fluoride by 147 plants, sodium silicofluoride by 176; hydrofluosilicic acid by 32; and hydrofluoric acid and ammonium silicofluoride by one each. Dry-feed equipment was used in 125 of the 182 new plants installed in 1952, or in 174 of the 176 plants replying to this question. Reported costs of complete fluoridation installations ranged from $300 to $12,000 for solution-feed types and from $750 to $90,000 for dry-feed equipment. The chief operating difficulty reported was clogging of the discharge line, thought to be due to the reaction of water hardness with sodium fluoride solutions. Some plants experienced arching and packing in the hoppers of the chemical feeders.

Five municipal defluoridation plants, serving a total of 5,000 people, are reported in operation. The concentrations at which defluoridation is recommended vary widely, ranging from 1.0 to 3.0 ppm.



Courtesy Jnl. AWWA.

● **Fluoride content and DMF incidence.**

"Census of Fluoridation in the United States and Canada, 1952." *Journal, Am. W. W. Ass'n*, August.

A New Type Of Spillway

Houston, Texas, to create a 160,000 acre-foot reservoir, has built an Ambursen-type dam 3160 ft. long and 45 ft. high on a none-too-stable soil. To minimize the erosive effect of flood flows on the sandy flood plain down stream, the whole dam is built as a long spillway, for which a novel design was adopted. From the crest of the spillway extends a grill of large, reinforced concrete girders, tapered downstream, wider at top than bottom and pitched sharply downstream, for the purpose of preventing drift from hanging up in the grillage; the purpose of which is to effect distribution and aeration of the overflowing nappe and dissipate energy. A hydraulic model study of this design was made in the University of Iowa laboratory of hydraulic research. Most of the overflow flows vertically through the grillage into a stilling basin lined with reinforced concrete, 110 ft. long and 21 ft. deep, at the down stream end of which is a steel sheetpile cut-off wall. Two tainter gates in the spillway will be used to vary the level of the reservoir surface frequently during mosquito-breeding season.

"Lightweight Dam to Pass Heavyweight Flows Over New Diffuser Spillway." *Engineering News-Record*, Aug. 20.

Problems in the Far North

In Northern Canada and Alaska, preventing the freezing of water in plants and in distribution systems is paramount in design and operation, and provisions for insuring it add greatly to the expense of both. The water is heated at the pumping plant and kept circulating through the mains and house connections by returning part of it to the heating plant continuously through 4-in. return lines, which are laid beside every main and house connection. All pipes are laid with at least 5 ft. 6 in. cover (8 ft. in one system) and are insulated with 1 ft. thickness of compacted moss. Even so, water leaving one plant at 42° is cooled to 35° at the end of the system, and any interruption of service for more than half an hour results in freeze-ups. Excavation in winter for reaching a leak or other purpose takes about two weeks, using jackhammers because of the hardness of the frozen ground, which is about like that of concrete. Powder cannot be used because of the proximity of the pipes.

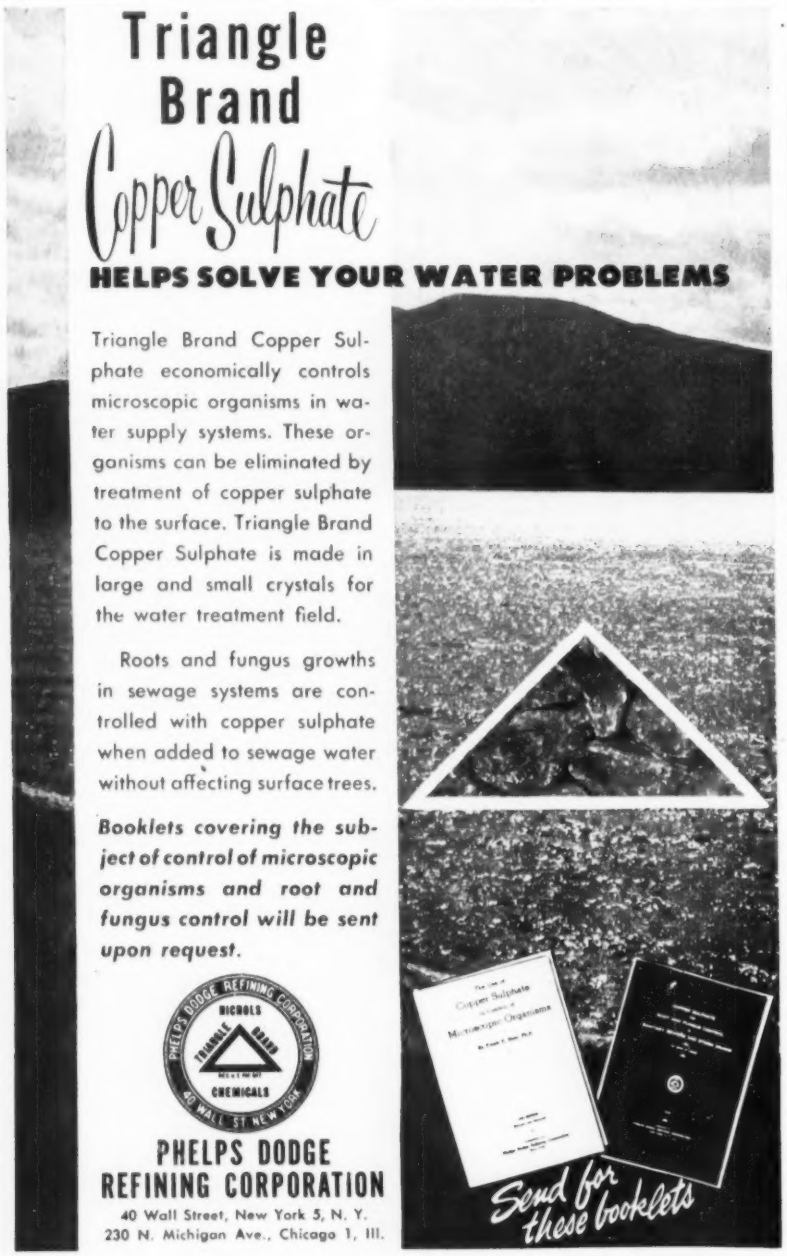
"Details of Two Far North Water Systems;" by Stanley S. Copp, Dept. of Nat'l Health and Welfare of Canada. *PUBLIC WORKS*, September.

Bulk Storage of Liquid Chlorine

Demands for liquid chlorine caused by World War II and the Korean war caused such difficulty in obtaining sufficient for water and sewage treatment that it seems necessary to provide facilities for

preventing the recurrence of such a condition. Maintaining storage of a reserve on the consumers' premises seems to be the surest method; but to do so by retaining the shipping containers for long periods would require the provision by the chlorine suppliers of a much greater number of containers, which would necessitate increasing the price of chlorine. A committee representing waterworks and sanitary engineers, the U.S.P.H.S. and the Chlorine Institute, believes that, "under the right conditions and with the proper precautions," stationary bulk storage of liquid chlorine is practical and feasible. The chlorine must be stored under pressure and the vessel would therefore normally be of the horizontal type with dished heads. It is advisable to have two tanks of identical proportions. The size must be at least great enough to hold 16 tons (the capacity of the smallest single-unit tank car) plus allowance for variation in scheduled arrival of cars. The tank should be as remote from buildings as practicable and not near combustible buildings or materials. It should be provided with access manholes, nozzles, inlets and outlets, vent and pressure gage; and be insulated. Only valves and gauges designed for chlorine service should be used. Provision for keeping track of the contents of the tank is necessary; the best is the use of scales—internal devices are good but the tank must be emptied to permit servicing them.

"Stationary Bulk Storage of Liquid Chlorine;" by A. S. Woodward, Penn. Salt Mfg. Co. and L. L. Hedgepeth, Am. Cyanamid Co. *Water & Sewage Works*, August.



Charges for Air-Cooling Water

The General Waterworks Corp., of Pine Bluff, Ark., found that water for air-conditioning had reached 10.2% of all the water sold, though used by only 1.2% of the consumers, and estimated that the amount would more than double in the next 5 years and that this would require large expenditures for increasing production and plant facilities and the distribution system. It seemed that this expense should be paid by those necessitating it, for collecting which the demand charge method was studied. It was calculated that a demand charge of $2.50 per ton per month during the five months, May to September, for air conditioning of 3 tons or more without recirculatory equipment, would provide the required amount, and this was authorized by the Arkansas Public Service Com'n. An argument in favor of this was that, at the present rates, the saving in cost of water by installing a recirculatory system would pay for such a system in 3 years. The demand charge went into effect this year, and it is hoped that this, added to the saving possible in water rates, will induce practically all users of air-conditioning water to install a recirculatory system.

"Demand Charge Approved for Water Service in Air Cooling;" by J. R. Pierce, V. P. Gen'l W. W. Corp. *Water & Sewage Works*, Aug.

Relationship Between Fluoride Content and Tooth Decay

The North Dakota Dept. of Health, in 1952, carried out a precise controlled dental survey of 3220 school children between 6 and 14 yr. of age, each of whom had used the water supply of a particular city throughout their lifetime. In some of these cities, the water had a low or zero fluoride content; another group contained those with a medi-

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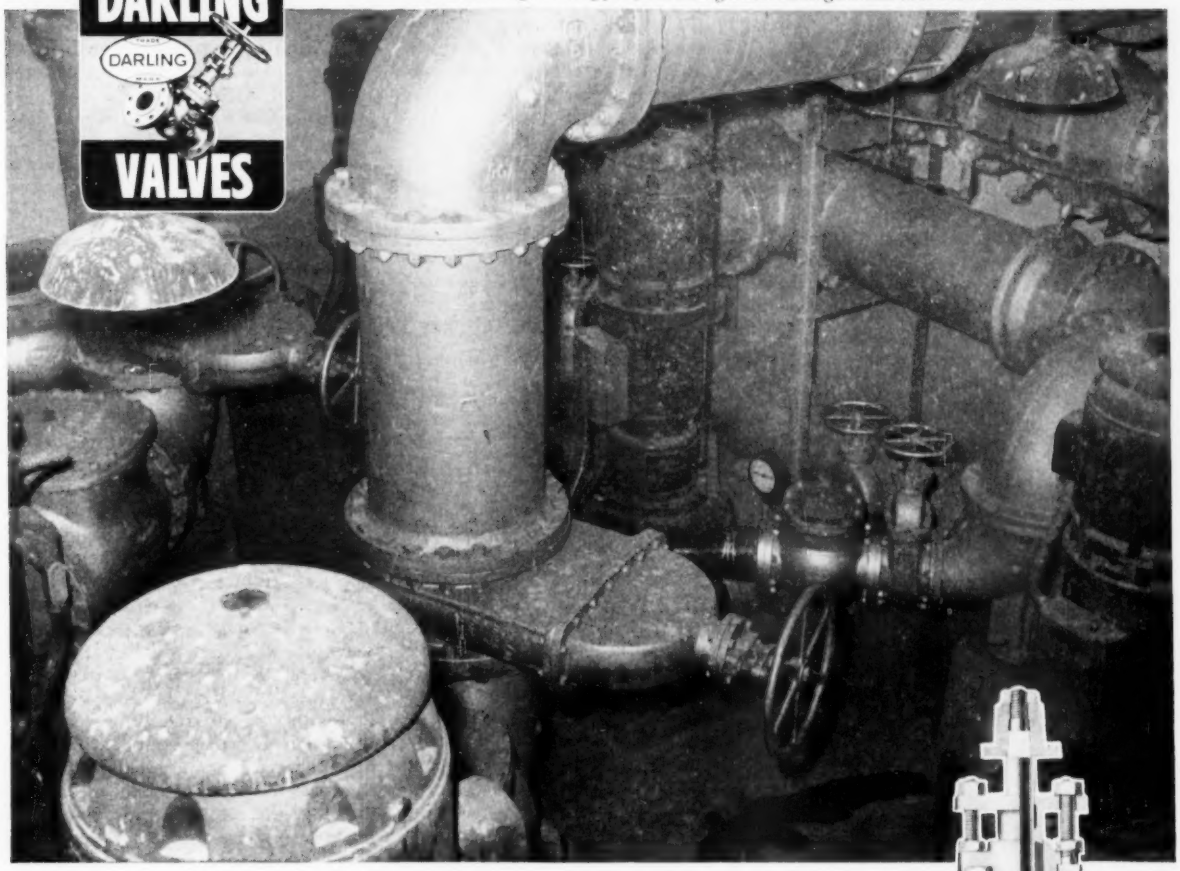
The Wet Well Pump Room in the central control building basement, showing Darling fully revolving double disc gate and check valves installed.

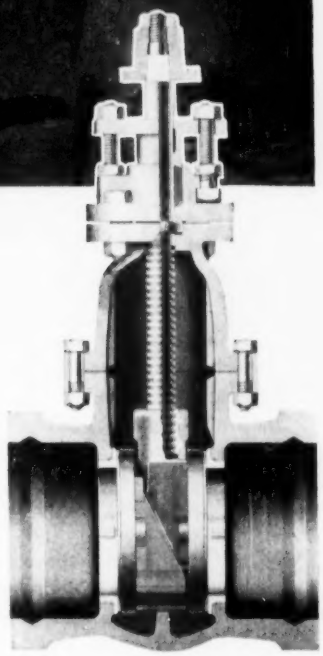


DARLING VALVES in Bethlehem's $5,000,000 sewage treatment plant

THIS new Sewage Authority settling plant, with maximum capacity of 25,000,000 gallons a day, handles the sewage load from 128 miles of Bethlehem, Pa.'s sewer system.

Unique Valve Principle—Darling gate valves, in the "heart of the plant", are closer to being trouble-proof than any you have ever run across. Darling's fully revolving double disc, parallel seat feature compensates automatically for valve body distortion. Tight closure is assured every time. In addition, wear on parts is less . . . and is uniformly distributed. Darlings last longer, require less attention and maintenance.

Valves For Every Need. In water and sewage plants everywhere Darling revolving double disc parallel seat gate valves are setting records for low-cost service. They are available in a wide range of sizes for all normal and unusual service . . . for pressures up to 1500 pounds. Write for all the facts to . . .



Rugged simplicity is the secret of better operation of the Darling revolving disc principle. Just four sturdy working parts . . . two plain interchangeable no-pocket discs and two husky wedges . . . do all the work. With this foolproof assembly of internal parts, maintenance is easy.

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um content, averaging 0.5 ppm; and in a third group the content was high, averaging 2.3 ppm. The data were obtained at North Dakota cities only, but comparison with information obtained from Grand Rapids, Newbergh and Aurora, indicated that the conclusions were generally applicable. These conclusions were that: There is a definite relationship between fluoride content and tooth decay. In the different groups, the relationship between age and DMF per child follows the same general type of logarithmic curve, which has a "break point," flattening out and showing a less rate of protection beyond the ages of 10-13, the age increasing with increasing fluoride content. Therefore, very low fluoride concentrations do as much good proportionately as the optimum amounts. For comparative purposes, protection rate values should be much better criteria than specific data on DMF per age group. ("Rate of protection" is defined as age in years, per DMF, and is the reciprocal of the rate of decay). Some factor other than the presence of fluoride retards decay between the ages of 8 and 11. Questions posed by the investigation were: Why does the rate of protection change above a certain age?, and what is the apparent anti-decay factor operating between the ages of 8 and 11?

"Effects of Fluoride in North Dakota Water Supplies;" by Arthur E. Williamson and Jerome H. Svore, N. D. Dept. of Health. *Journal, Am. W. W. Ass'n.*, August.

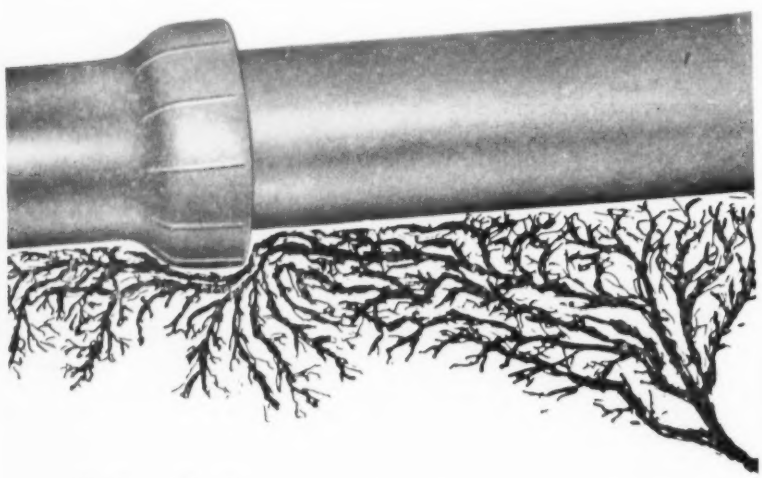
Deaeration for Preventing Corrosion

In constructing the water supply system for the U. S. Naval Hospital at St. Albans, Long Island, N. Y., during World War II, steel pipe was used to conserve other materials. The deep-well water supplied is very corrosive to steel and by 1948 a serious condition of the piping had developed. To remedy this, in 1951 a vacuum deaeration system was installed and the piping cleaned. The deaeration system comprises booster pumps, rate-of-flow controller, vacuum deaeration tank, steam ejector, service pumps and elevated storage tank. The deaeration tank is of steel, 7 ft. diameter and 20 ft. high, containing multiple layers of wood slats, the purpose of which is to give the water as much surface as possible to facilitate the removal of the dissolved gases by the steam ejector. The water enters at the top, is sprayed onto the wood bundles and passes to the service pumps through an outlet pipe at the bottom. The well water can be expected to be saturated with air and contain 15 ppm of carbon dioxide. To reduce the contents to 0.3 ppm of dissolved oxygen and 5 ppm of free carbon dioxide, a vacuum in the deaerator of at least 29.1" of mercury was specified. The 100,000-gal. elevated tank has a floating cover to prevent the water in it from coming in contact with the atmosphere and reabsorbing gases; and the water in the tank is heated in winter to keep the cover operable.

"Rust in Water System Checked by Deaeration;" by J. L. Staunton. *Engineering News-Record*, Aug. 27.

Defluoridation of Municipal Water Supplies

Excessive concentrations of fluoride are associated with dental fluorosis; children who have continuously used water containing 6.0 ppm or more are, without exception, afflicted with mottled enamel of the permanent teeth, and many of them have gross calcification defects and loss of enamel through attrition, defects which are permanent



JC-60 SEWER JOINTS
. . . actually turn roots away

An ordinary root may exert pressure as high as 50 psi at the tip. Thus, it is easy to understand why roots are a common cause of sewer line destruction . . . and why foresighted engineers specify ATLAS JC-60®, the synthetic plastic base, *root resistant* jointing compound.

Roots cannot penetrate the surface of a JC-60 joint. JC-60 is hard . . . so hard it forces roots to change direction. At the same time, *high adhesion of JC-60 prevents roots from entering between the pipe and the compound.* Even at maximum pressure, ordinary roots cannot break the tight bond that JC-60 provides at the joint interfaces.

Furthermore, JC-60 *retains* this combination of characteristics. Even after hours of overheating in the melting pot or pouring under adverse conditions, properly poured ATLAS JC-60 still provides tight root-proof joints that withstand normal settling without failure . . . reduce infiltration and exfiltration to a minimum . . . resist chemical and bacterial attack.

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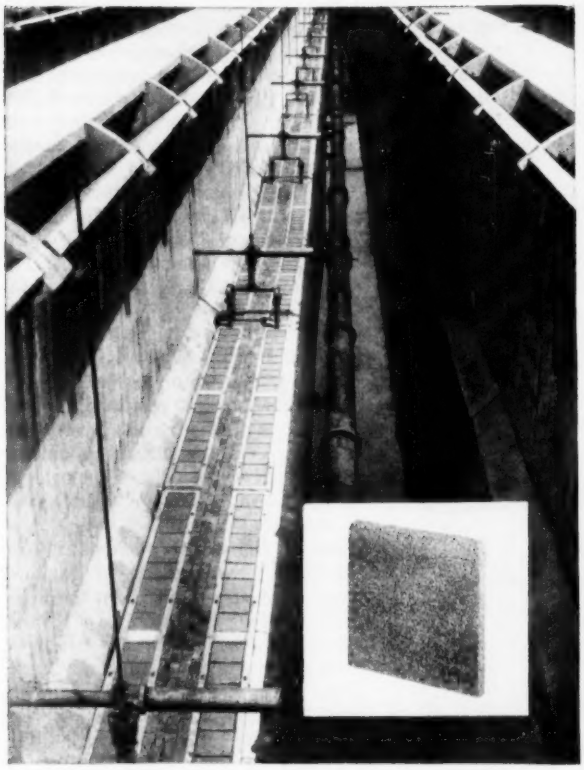
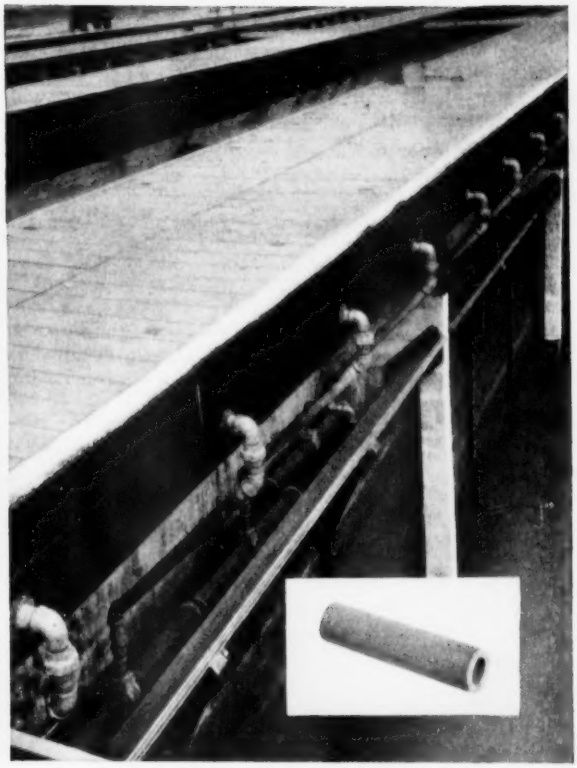


Installation of Norton porous plates in a sewage disposal plant.



A method of suspending Norton porous tubes in a sewage disposal plant.

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There's only one "controlled structure" process for making porous plates and seamless tubes — and that is the Norton process.

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and cannot be ameliorated. A million or more persons in more than 500 communities use water containing more than 1.5 ppm of fluoride, but only five plants have been built for fluoride removal. The U.S.P.H.S has endeavored to learn the best type of plant to recommend for this purpose, and since March 1952 has been operating a full-scale plant at Bartlett, Texas, the water supply of which has the highest fluoride content of any public supply in the country—8.0 ppm. Various processes have been recommended for this purpose, but those considered practicable were narrowed down to use of calcium phosphates, anion-exchange resins, magnesia, or aluminum compounds. The method selected for this plant uses 500 cu. ft. of 28-48 mesh alumina, with a density in place of 50 lb. per cu. ft., assuming a 400 gpm flow-through rate and one regeneration per week during the winter. This is contained in a steel tank, with underdrains, wash troughs, and a "Saran" distributor; a 6,000-gal. caustic solution tank with mixer and pump; and acid dilution tanks with metering and proportioning equipment. Using this plant, the cost of chemicals to remove 7.0 ppm fluoride is $52 per million gallons. The equipment cost $11,360; the alumina bed cost $4,000 in place. One man, working part time, operates the plant and makes the necessary chemical tests.

"Defluoridation of Municipal Water Supplies;" by F. J. Maier, Director, Div. of Dental Pub. Health, U. S. P. H. S. *Journal, Am. W. W Ass'n.* August

Microstrainers For the United States?

The author has visited some English installations of the Microstrainer, a fine wire mesh strainer made by an English firm (Glenfield & Kennedy), has studied reports of its operation, and come to the conclusion that there are very few places in this country where its use would be advantageous. In England its greatest application is in the pretreatment of water ahead of slow sand filters, which still are the prevailing type in that country. These filters are greatly troubled with algae in the raw water, and it has been common practice to pre-filter the water in scrubbers similar to our rapid sand filters but without use of coagulants. It is as substitutes for these that the microstrainers are used. In a comparison made in England by operation of sand prefilters and microstrainers in the same plant, the latter were not so effective in increasing the capacity of the slow sand filters, had no effect on ammonia nitrogen, and reduced turbidity only slightly, both of which were reduced substantially by the prefilters. However the cost and amount of wash water used were sufficiently less to cause their adoption in several recent plants. For the few slow sand filters in this country, and for removing plankton from water for industrial use, they may find a place.

"Application of the Microstrainer to Water Treatment in Great Britain;" by Richard Hazen. *Journal, Am. Water Works Ass'n.*, July.

Revised Procedure For Disinfecting Mains

The Committee on Main Disinfection of the Am. W. W. Ass'n has revised the procedure for disinfecting water mains as recommended in 1947. It comments: "There is still much to be learned about main disinfection. The committee does not believe that the revised procedure will remain in its present form indefinitely. . . There is substantial evidence, however, that the revised

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For details, wire or write McWANE CAST IRON PIPE COMPANY, Birmingham, Alabama, or PACIFIC STATES CAST IRON PIPE COMPANY, Provo, Utah. (Sales offices in principal cities.)

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procedure is workable, and, at present, no evidence exists that it will not produce satisfactory results."

Sometimes, or perhaps often, a newly laid main may not require more than flushing; but this can be decided only on the basis of tests of the water by competent authorities. As for swabbing a new pipe, the need for this in each case is left to the judgment of the person directing the main-laying program. The revision reduces the magnitude of chlorine application and chlorine residual remaining after the recommended contact time. No procedure for disinfection of jute is included, because jute is not listed as acceptable packing material. The committee attaches considerable importance to maintaining a velocity of not less than 2.5 fps through the main being flushed; but even this can be relied upon for removing only the lighter solids. It also emphasizes that bacteriological quality cannot be judged from samples collected from hydrants. The only disinfecting agent recognized is chlorine in one of several forms. Several other disinfectants have been found entirely satisfactory, particularly in swabbing; and these may be used if they have been tried and approved by the local health authorities.

"Revised Main Disinfection Procedure;" by Marshall P. Crabill, Chrmn. of Committee. *Journal, Am. W. W. Ass'n*, August.

• • •

Legislative Changes in Vehicle Sizes and Weights

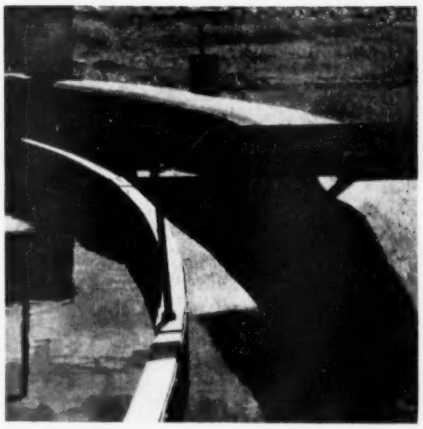
Certain trends are evident in the recent legislative action concerning vehicle sizes and weights. One is a tendency to increase the length of buses. Many states now have a 40-foot maximum and one, Delaware, permits a length of 42 feet. Several states limit the greater lengths to cities or certain designated highways. A few states have increased the width of buses used in or near cities to 102 inches.

A general tendency to increase maximum total weight of multiple axle trucks is evident. New values range from 48,000 to 76,800 pounds but generally carry other restrictions. Heights up to a 13½-foot maximum are now permitted in a few states, evidently to accommodate auto transport haulers. Weight restrictions are tied into the new height maximums in most cases.

These data were obtained from a report of a legislative action survey by the Highway Users Conference.

Is Skimming in the Settling Tank Following a High Rate Filter Beneficial?

NOTE the accumulation, in one hour, of dead filter flies in the race of a Final Spiraflo Settling Tank following a high rate filter.



Positive skimming afforded by Spiraflo Tanks is just another reason why plants which use these clarifiers are producing better than average results.

Write for bulletin 122 for Spiraflo Clarifiers and bulletin 124 for Spiragesters.

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THE SEWERAGE AND REFUSE DIGEST

Predicting Results Of Treatment by Trickling Filters

"The treatment of sewage using standard primary and secondary clarifiers and either bio-filters or standard-rate filters has now reached the stage where an engineer can provide a well designed plant and can predict within a very small range the actual BOD of the final effluent from the plant." This statement the author substantiates by citing the records of three plants having different rates of recirculation and different depths and kinds of filter medium. In one case it was estimated that the effluent would contain 30 ppm of BOD, and during two years of operation, tests showed 29 and 26 ppm BOD. In a second case, an effluent with a BOD of 25 ppm was expected, and a year after it went into service, a test showed 22 ppm. In the third case an effluent of about 20 ppm BOD was anticipated, and a test during the first year of operation showed 14 ppm, and one during the second year 12 ppm.

"Design Takes the Guesswork Out of Trickling Filters;" by Olney Borden. *PUBLIC WORKS*, September.

Disposal of Milk Wastes by Small Plants

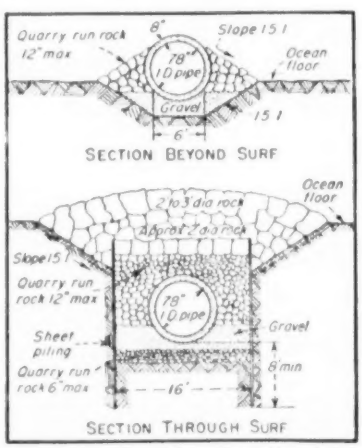
A large percentage of the dairy receiving stations and processing plants are small, but are nevertheless required by state laws to treat their wastes. In some cases the maximum waste volumes are as low as 2,000 gpd and the BOD loads as low as 5 to 10 lb. per day. Simple but satisfactory plants are described, and the author says that it is possible to build dairy waste treatment plants consisting essentially of only an aeration tank and a small final settling tank, using an air supply as low as 0.5 cfm per pound of BOD per day.

"Recent Developments in Design of Small Milk Waste Disposal Plants;" by J. P. Horton and H. A. Trebler, Nat'l Dairy Research Lab. *Sewage and Industrial Wastes*, Aug.

Placing a Long Ocean Outfall

The longest ocean outfall on the Pacific coast—7,000 ft. is being laid for the County Sanitation District of Orange Co., Calif. The outfall is a 78-in. reinforced concrete pipe. It is delivered by barge in 24-ft. lengths which are placed on the ocean bottom near their final position by means of a 50-ton crane mounted on the barge. Later, each length is lifted and suspended over a prepared gravel bed by means of a 4-legged tower standing on the ocean bottom in water as deep in some places as 55 ft., and is lowered by hand winches to the proper grade in a trench which has been dredged with jet-agitated suction, and additional gravel is jetted under it through under-water tubes. Two divers guide the seating operations and manipulate the gravel tubes. The proper level of each pipe is determined by two tide gauges; a permanent one near shore, the reading of which is taken by field glasses by the contractor's engineer, and a portable one mounted on the outshore end of the length being handled. The joints are machined cast iron with a rubber gasket, supplemented by an external bolting device to prevent the joint opening; the bolts being loosened slightly after an additional 500 ft. of pipe has been laid to permit some adjustment in case of movement of the ocean floor. The pipe then is covered with gravel or quarry rock. Specifications set a limit of leakage of 7800 gal. per mile per 24 hours. Tests under 10 psi pressure have shown no leakage so far.

"Tower Places Ocean Outfall," *Engineering News-Record*, Aug. 20.



Courtesy Engineering News Record

● **Section through 78-in. outfall.**

Sludge as a Soil Improver

During the past few years the Connecticut Agricultural Experiment Station has conducted tests to learn if sewage sludge would increase crop yields, if it has an overall beneficial effect on the soil, and what other effects, if any, it has on plants. They found that Connecticut sludges contain rather high concentrations of boron, copper, and especially zinc, and that these elements may be toxic to beets and especially spinach in acid soil, but not to grasses and small grains; but that the injurious effects are usually eliminated by adequate liming. Connecticut sludges were found markedly beneficial to soils and, when used under proper conditions, improved crop yields. Growth of small grains and grasses was generally increased irrespective of soil pH; of crops like beets and spinach, only where the soil pH is 6.5 or higher; and coniferous nursery stock is probably benefited by moderate rates of sludge where the soil acidity is at pH 5.3-5.8. Few other additives to soils are as effective as sludge in increasing organic mat-

ter, total nitrogen and soil aggregation. It increased field moisture capacity and cation exchange capacity 3 to 23%, organic matter content 35 to 40%, total nitrogen up to 70%, and soil aggregation from 25 to nearly 60%. The New York City Park Department uses digested sludge in the preparation of artificial top soil. Most sludges tended to delay germination of lettuce, beet, bean and oat seed, but this was less if the sludge had been piled outdoors 6 months or longer.

"The Case for Sludge as a Soil Improver;" by Herbert A. Lunt, Soil Scientist, Conn. Agr. Expt. Station. *Water & Sewage Works*, August.

Effect of Refuse Compost on Soil

A "technical assistance mission" of the Organization for European Economic Cooperation, after a month's inspection of 34 cities in 6 different countries, has published a "synthesis of the most modern techniques employed in the countries visited" in refuse collection and disposal. Special attention was paid to the use of a refuse for agricultural purposes by grinding, composting, etc. They report that compost increases the physical fertility of the soil by supplying stabilized humus in a proportion of about 3%; unstabilized humus in a proportion of 2-9%; it contains unburned porous coke particles from heating installations, which increase the porosity physically; extreme fine particles, in proportions of 7.5-10%, which increase the water retention capacity of the soil; and 3% or so of lime, which improves the pH value and provides a better medium for bacterial life. Humus and the activated bacterial life increase the buffer capacity of the soil for both cations and anions. It restores the biological equilibrium of the soil by creating conditions more favorable to the existence of bacteria. Trace elements in the compost stimulate certain of the vital functions of plants. Iron, manganese, copper, boron, zinc, chromium and molybdenum are essential to plant life and all are found in refuse compost.

"OEEC Report on Refuse Collection and Disposal."—*Municipal Engineering*, (England), July 24.

Disposal of Sewage in Lagoons

Disposal of sewage in lagoons has been practiced to some extent in the warm, dry climate of the south-

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west, but in northern climates, where ice covers ponds for three or four months of the year, it has not been used much except in North Dakota, where it is favored by the State Dept. of Health. The first lagoon in that state has been in operation since 1928. The requirements for successful treatment of domestic sewage are sunshine, wind and cheap land. The effluents are clear, well stabilized, practically free of pathogenic organisms. No objectionable odors develop. In many North Dakota lagoons, there is no effluent because of evaporation and percolation. It is recommended that the lagoons have an area of 10 acres per 1,000 population; water depth between 3 and 5 ft. Sewage should enter at the center of the lagoon, a foot or so above the bottom. Dikes should be of well compacted impervious material. The water surface should be exposed to a clean sweep of the wind, to promote aeration. During winter, ice will prevent evaporation and biological activity, and the wastes are held in storage until spring; but in summer algae grow profusely and supply large amounts of oxygen so that supersaturation often exists. One lagoon removes 95% of the BOD. The State Fish and Game Dept. uses some lagoons for rearing fish.

"Sewage Lagoons — Low-Cost Treatment and Disposal Method;" by William J. Wenzel. *Engineering News-Record*, Aug. 20.

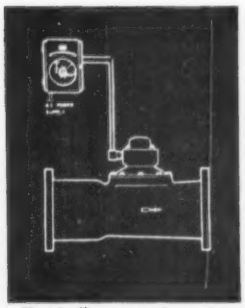
Thermophylic Digestion Of Brewery Wastes

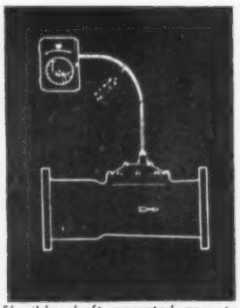
A sewage plant built by the Adolph Coors brewery to handle its wastes combined with the sewage of the city of Golden, Colo. is notable because it uses thermophylic digestion at a temperature of 130° F in the primary digester, and uses the first pressure flotation unit in the country for concentrating the sludge. The purpose of the flotator is to obtain a denser sludge, thus reducing the quantity of water handled in the digester. Sludge is super-saturated with air and this, on entering the flotator, rises to surface, bringing the suspended matter with it, where such matter is scraped off and discharged into the primary digester, containing 6% to 12% solids, thus having only 1/4 to 1/8 the volume of the tank sludge. Thermophylic digestion causes a 75% reduction of volatile solids in 17 to 20 days, while mesophylic digestion gives 55% reduction in 30 to 60 days. It is reported that thermophylic bacteria penetrate oils and attack the organic matter to prevent formation of a sludge mat, which mesophylic bacteria do not.

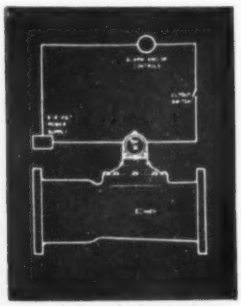
"Brewery and City Wastes Combined in Unusual Disposal Plant Near Denver."—*Engineering News-Record*, Aug. 27.

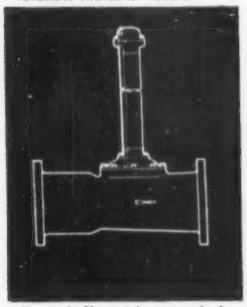
Flotation for Clarifying Industrial Wastes

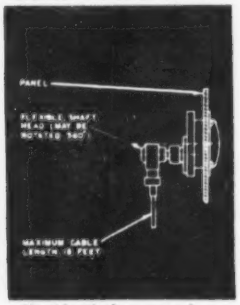
Flotation may be either that produced by violent agitation, or quiescent. The latter is suggested for the clarification of certain industrial wastes. In some cases use of conventional settling equipment is the most effective method; but there are many industrial wastes that can best be clarified and purified by flotation; and for others, settling is best for removing the heavier suspensions, followed by flotation for removing the lighter. Suspensions that settle slowly or that remain suspended can be agglomerated and buoyed to the liquid surface quickly and thoroughly by the lifting power of tiny air bubbles attaching themselves to the suspension particles. The floated suspensions are readily removed continuously and collected


Electrically operated remote totalizer-indicator-recorder


Flexible-shaft-operated remote totalizer-indicator-recorder


Propeloflo with electric alarm totalizer


Propeloflo with extended totalizer



Flexible-shaft-operated remote totalizer

Electrically operated remote totalizer

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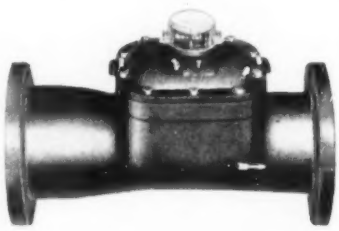

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as a concentrated sludge, which drains freely. The effluent water from quiescent flotation usually contains quantities of dissolved oxygen, often to the point of saturation.

Another type of flotation, as opposed to the entrained air or gas flotation, is the dissolved gas flotation, in which injected air is placed in true solution in the liquid flow by increasing the liquid pressure in a continuous-flow retention tank, then releasing the flow to atmospheric pressure, when the gases coming out of solution are immediately adjacent to or upon or within the solid to be floated. This method has been widely used by the paper industry for highly efficient removal of fibrous and filler materials from white water.

By F. S. Gibbs and Robt. A. Baum in "1952 *Industrial Wastes Forum.*" *Sewage and Industrial Wastes*, June.

Rapid Methods of Analysis in Waste Treatment

For many purposes in controlling the treatment of wastes, the use of the standard BOD determination takes too long and many operators have developed substitutes which they consider preferable for their purposes. Three procedures are described in this issue of Sewage and Industrial Wastes: "Rapid Procedure for Estimating Organic Materials in Industrial Wastes," by J. G. Niedercorn, Sumner Kaufman and Harold Senn, of Lederle Laboratories; "Periodate Oxidation of Pea Cannery Wastes," by Roy B. Flay, State College of Washington; and "Rapid Analysis of Packinghouse Wastes," by Karl A. Hirlinger and C. E. Gross, Research Laboratories, John Morrell & Co.

Concerning the last, the authors say that data sufficiently reliable for good plant control and for estimating the probable effect of discharged wastes on the receiving stream can be obtained the same day the sample is taken.

Sewage and Industrial Wastes, August.

Self-Purification Of Red Clay Creek

From a comprehensive study of existing pollution and stream self-purification within the Red Clay Creek drainage basin in the state of Delaware, made by engineers of the Delaware Water Pollution Com'n and State Board of Health, it was concluded that stream self-purification, as measured during a stream flow time of 14.5 hr. and a distance of 5.3 miles, resulted in approximately 60% reduction of the BOD and approximately 70% of the color, but only 10% of the suspended solids. The self-purification could not be attributed to suspended solids removal or biological activity, but only to the effects of direct oxidation and possibly to slime growth on the rocky stream bottom. The major pollution in this stream is strong blowdown waste from two fiber mills, coming in slugs at intervals of 1/2 to 1 hr. The stream bed is very rocky and contains many rapids.

"Pollution Study of the Red Clay Creek Drainage Basin:" by A. Joel Kaplovsky, Eng. Del. Water Pollution Com'n., and Herman Mandel, Harry F. Camper and James D. Murphy, Chemist & Engrs., State Bd. of Health. *Sewage and Industrial Wastes*, August.

Making Garbage Into Cattle Feed

Omaha, Neb., for years disposed of its garbage by feeding it to hogs, but this became illegal in September 1952, when a state law went into effect. Meanwhile the Central

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States Corp., a local alcohol plant, experimented in drying it in a standby battery of dryers normally used for drying spent grain. These are rotary-drum flash dryers 60 ft. long. The result was found to be satisfactory if the garbage was ground first, for which purpose a hammermill was used. The material reaches a temperature of 260° F and is sterile. The city accepted a proposal from the Central States Corp. to subsidize the process at $30,000 for a year, until markets could be well established and the necessary equipment obtained. It is expected that the process will be self-sustaining and profitable but will never pay for collecting the garbage.

"Omaha Makes Feed Out of Garbage;" by Herbert H. Ulrich, Omaha Sanitation Commission.—*American City*, August.

Recovery and Treatment of Chromium Wastes

Chromium wastes can be handled by either recovery or treatment. The author first discusses minimizing the amount of waste by process control and the concentrations in plant effluent acceptable to city and state regulatory agencies. The method of reduction by sulfur dioxide, and equipment and methods for redox control are then described, and chromic acid recovery by ion exchange are practiced by Grumman Aircraft Eng. Corp.

"Chromium Wastes—Recovery or Treatment;" symposium by Kenneth S. Watson, Coordinator of Waste Treatment, Gen. Electric Co.; H. B. Channon, Virginia Smelting Co.; W. N. Greer, Leeds & Northrup Co., and Durward T. Armstrong, Grumman Aircraft Engineering Corp. *Sewage and Industrial Wastes*, August.

Slime Growth on Submerged Surfaces

Slime growth on submerged surfaces in contact with water polluted with sewage and industrial wastes is common and causes considerable maintenance and engineering problems. Possibly the slime contributes to the septicity of the sewage and to hydrogen sulfide production. A study was made of the effect of each of 35 protective coatings and inhibiting materials in preventing slime growths on concrete. Three samples had inhibitors incorporated in the concrete; 23 coatings were without inhibitors, and 9 contained an inhibiting agent. It was found that the accumulation of slime is not continuous but is reduced intermittently by sloughing. Complete inhibition was not obtained with any of the materials, even for short periods, although a few retarded the growth at first but not for long. Unless the growth is *completely* inhibited, the formation of a slime coating will reduce the effectiveness of the inhibiting agent. Smoothness of surface has no effect—slimes will grow on glass.

"Protective Coatings and Slime Growths;" by H. Heukelekian and E. S. Crosby, N. J. Agri Exp. Sta. *Sewage and Industrial Wastes*, August.

• • •

Dump Fire Burns 16 Years; Now There's a Sanitary Fill

The Newberry, S. C., city dump caught fire in 1935 and resisted all efforts toward extinguishment for 16 years. In 1951, an International tractor with a bullelam was put to work. All of the old dump was moved by dozing into gullies and eroded areas and covered with compacted dirt. This put out the fire and cleaned up the old dump. Since 1951, a sanitary fill has been in operation—and no fires have occurred.

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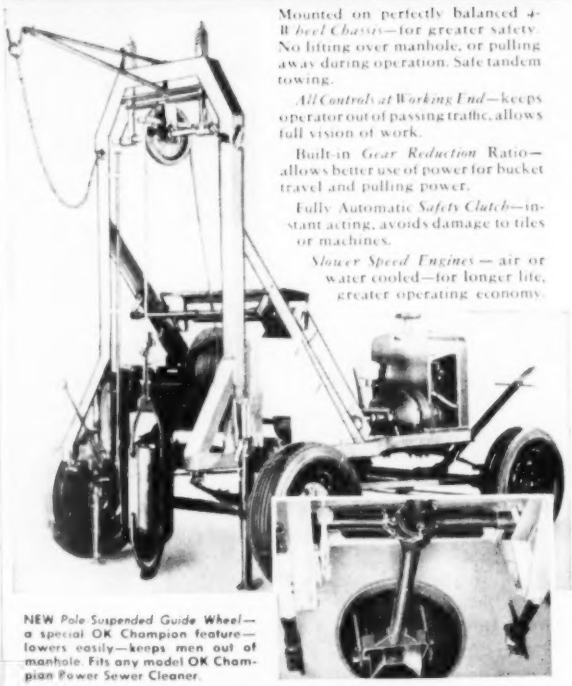

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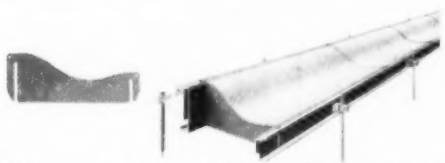
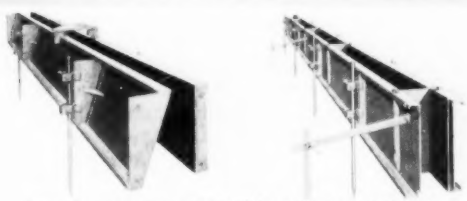
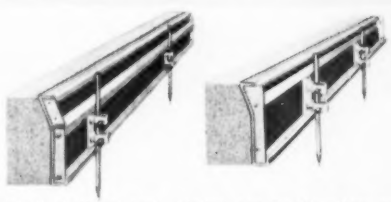


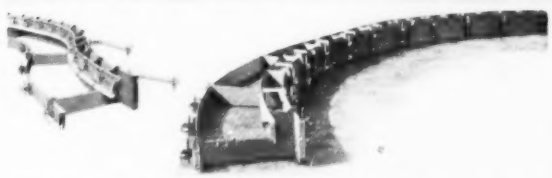
Two of the many variations possible with the popular **Helco Basic Forms.** These forms are designed to permit contractors to work **an almost** endless variety of curbing styles from the same basic set. All **Helco Basic Forms** are made of long lasting tough carbon manganese steel in 10' sections.



For curb work 12" to 24" in height, Heltzel has designed a **heavy duty dowel joint form** that has found ready acceptance in the field.



For partially battered curbs Heltzel can furnish either one or two piece front forms depending on your job requirements.



Heltzel builds a complete line of **Radius Forms**—either Rigid or Flexible. All forms are built to exact cross sectional specifications. Flexible Radius Forms are ideal for serpentine work for parks, etc.; Rigid Forms for repetitive curve pours where the radius is constant.

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Chemistry

(Continued from page 85)

FeOH. The reaction of an acid and a base produces a salt, as NaCl, $CaCO_3$ and $CaSO_4$. The gram-equivalent weight is the gram-molecular weight divided by the number of hydrogen or hydroxyl ions entering into the neutralizing reaction. For instance, $CaSO_4$, calcium sulphate, has the equivalent of two ionizable hydrogen atoms, that is, the Ca ion can be replaced by two H ions (to produce sulfuric acid). The gram-equivalent weight is therefore one-half of the molecular weight or 68.07. Aluminum sulfate is a little more complicated. It has the formula $Al_2(SO_4)_3$. The molecular weight, obtained by adding the atomic weights of the elements which make it up, is 342.12. It will be noted that there are three SO_4 units combined with two Al units. We know that 2 hydrogen atoms combine with one SO_4 (H_2SO_4); in aluminum sulfate, the Al_2 must be equal to six H ions. Therefore the gram-equivalent weight of aluminum sulfate is one-sixth its molecular weight or 57.02.

Additional installments of this article on chemistry for water and sewage treatment will appear in future issues.

• • •

Shoulder Construction

(Continued from page 81)

able Pug-Mill and a motor paver in constructing shoulders but these have not advanced far enough to arrive at any definite conclusions. The aim is to produce a material approaching the durability of plant mixed bituminous concrete but at less expense.

When the Merritt Parkway was constructed, lanes in each direction were built to a total of 26 ft. in width with curbs both on the outside and on the center mall. There were no shoulders. Gradually the department is eliminating the outside curb and constructing bituminous macadam shoulders. At present motorists are instructed to park on the grass area outside the curb. This is not a satisfactory arrangement, especially in the early spring or during wet weather. With an 8-ft. to 10-ft. shoulder there will be sufficient width for motorists to pull off the travel path to make emergency repairs such as changing tires and the added width will also aid materially in our snow plowing operations.

Sod Shoulder Experience

The department has experimented with stabilized sod shoulders but because Connecticut is a highly industrialized state with all state highways quite heavily traveled, sod shoulders have proven unsatisfactory. Many states find the turf or sod shoulders desirable and economical on certain of their highways and no attempt is being made to discredit their use where conditions are favorable. Some of the disadvantages found in Connecticut are as follows:

Reluctance on the part of motorists to use the shoulder in making emergency repairs, resulting in the travel path becoming partially blocked.

Difficulty in plowing snow beyond the edge of the pavement without destroying the turf. Unless the snow is plowed well back on the shoulders a series of storms narrows the roadway rapidly causing hazardous driving conditions. A gradual build up of growth at the edge of pavements prevents storm water from draining

Made-up Mechanical Joint cut away to show its design.

The use of mechanical joints for pipe, valves and hydrants is growing rapidly. The reasons are easy assembly, saving in time and labor cost, and flexibility that maintains a tight, leak-proof joint under conditions such as pipe line expansion, contraction or settling.

M & H Mechanical Joint hydrant is standard compression type. The main valve opens against the pressure. Hydrant valve will remain closed in case hydrant standpipe is broken off in traffic accident. Other features include low friction loss, revolving head, dry top, easy lubrication. Hydrant shoe has two heavy lugs for use in strapping hydrant to dead-end pipe line.

M & H Mechanical Joints are made in accordance with A.S.A. standard specification A21.11, 1952, as approved by American Water Works Association, in which a thick gasket of triangular cross section is compressed by a bolted follower ring.

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properly, which in turn causes the pavement to disintegrate, especially along the edge. Even on a road with moderate traffic it has been difficult to maintain a satisfactory stand of turf on shoulders, resulting in a very unsightly condition.

Quoting again from the "Policy on Maintenance of Shoulders", published by The American Association of State Highway Officials: "Turf shoulders are not practical on heavily traveled, narrow pavements at the outskirts of municipalities, urban sections, congested rural areas, or at mail box turnouts, in front of schools and other similar places". It is difficult to find very many locations on state maintained highways in Connecticut where this statement does not apply.

With the cost only slightly higher for the bituminous concrete shoulders than for oiled gravel the practice of using a high-type shoulder surface has been extended to practically all classes of Connecticut state highways.

For concrete surfaced highways bituminous concrete shoulders are used. For bituminous concrete surfaced highways, bituminous macadam shoulders are used. For bituminous macadam pavements the shoulders are built of the same surface construction with an asphaltic seal coat and pea gravel cover to give contrast from the traffic lanes. On A and B rural classified roads where traffic is under 1450 cars daily, oiled gravel shoulders are standard.

• • •

Getting Incineration

(*Continued from page 83*)

In such cases, guidance of competent consulting engineers is of vital importance in analyzing the problem, and in determining the character of the refuse, and the changes or enlargements necessary to meet present-day conditions.

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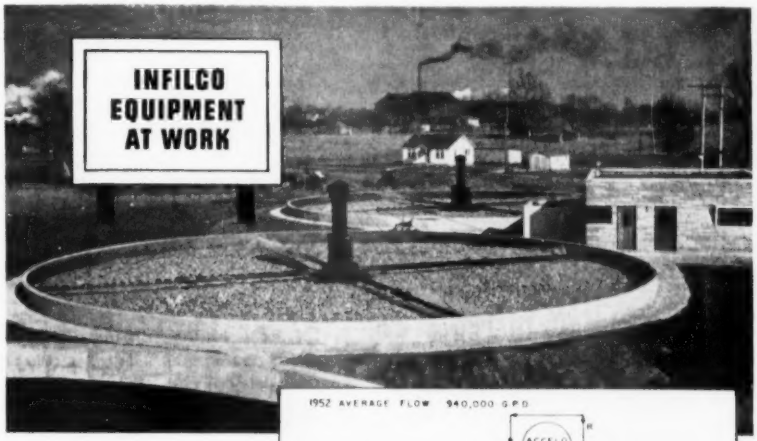
Ours is a "packaged life", from toothpaste to sewage disposal plants. Why not packaged incinerators for the small communities? For years, incinerator parts have been shipped all over the world to be erected by local help, from clear detailed prints and instructions. The same thing is possible right here and now as a help in solving this important and troublesome municipal problem of refuse disposal, especially in small communities.

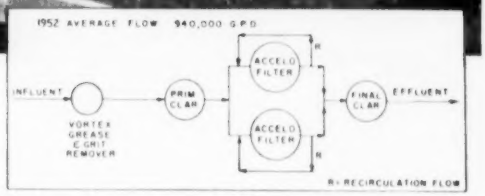
City Refuse Practices

(*Continued from page 74*)

year: three 12-yd. trucks; 6 cu. yd.; 6¼ cu. yds.; 2.7 cu. yds.; 860 lbs.; 1.7 tons; 1,000 lbs.; 1,048 lbs.; 1.7 tons; 5,760 lbs.; 300 lbs.; 1,148 lbs.; and 1,083 lbs. It is the opinion of the Editor that reliable data are not available; and probably that local conditions influence results. For instance, where volume measurements are reported, the difference in results when using packer-type and open trucks is marked.

In the 1940 and 1946 surveys, considerable data were presented on amounts and weights of garbage and rubbish as reported at these times. The information reported in the 1953 survey cannot readily be compared with the previous data; and conditions have probably changed so that the former information is no longer reliable. Due to greater use of frozen vegetables, and similar foods having a minimum of waste, the volume of garbage and its moisture content has been reduced over the past few years, with a corresponding reduction in unit weight.





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"Doc" Symons

(Continued from page 18)

(Toledo Water Comm.) Van Dorp's article in PUBLIC WORKS where the phenomenon was first analyzed.

First person really to use the "Teieflush" method, however, was the late Mayor F. H. LaGuardia of New York City. The "Little Flower" before his weekly radio talks, used to call Joe McGittrick of the N.Y. Water Dept. and say, "Joe, I'm goin' on the air at 12 o'clock—at 12:05 check the meter [Catskill Aqueduct] . . . . if they're takin' baths, it's a cinch they ain't listenin'."

★ ★ ★

Question of the Month — Don Bloodgood, Purdue's Professorial Purveyor of Profundity on Public Health Engineering, asks, "Are municipal water softening works, 'hardness reduction plants'?".

★ ★ ★

What's In A Name—Some years ago, Bob Frazier, Supt. of Sewage Treatment at Oshkosh, Wis., did a piece in the Wisconsin Sewage Assn. magazine on the names of members. Without his permission, I'm going to reprint it here, because it's clever.

"The river became polluted and a STORM from the people of the TOWNE, ROSE and stated that it GASSEN STANK and became WILDE. The ENGER of the people caused the SCHERF to have them ROLL in for a meeting to see HOWE in ELLIOTT the BAHR SANDS and WEIGHLY and CRAWLEY waters could be cleaned. During JUNE and SOMERS, the river was bad and it was not too good during the WINTER, either. A TROMP along the river for fishing resulted in no LUECK and a HUNT was out of the picture.

"BROOME swept out the HALL, for the HAY was everwhere. ADAMI called the meeting to order and there was LORD to act as president. A MOLL appeared and there was a CLAPPER of commotion. Order was restored and the people wanted to LEARN how to overcome the river trouble. Funds were needed and NICHOLS were collected and placed in a SACK for future use. The organization was BORN and a MOTIF was set to carry on for a GRADE of DRESS that would clear the stream so that the MOON and SUND could be appreciated along the stream.

"DIMMIT, I BOETTCHER in the near future BATES can be used for

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★ ★ ★

Question of the Month — Don Bloodgood, Purdue's Professorial Purveyor of Profundity on Public Health Engineering, asks, "Are municipal water softening works, 'hardness reduction plants'?".

★ ★ ★

News Notes from Brushy Bend — At Wanakah, N.Y., (west of Buffalo) on Aug. 20, A.M. (Ted) Roberts sole owner of the Wanakah Water Co. held his annual party for the gang of water works men and manufacturers' Reps from Western, N.Y.

★ ★ ★

That'll be all for a spell—
V.T.Y.—Doc Symons

• • •

Composting

(*Continued from page* 132)

best sell compost on its merits as a soil conditioner, without additives.

2. The present price of compost sold to specialty gardeners and nurserymen (reported to be $68 per ton by Frazer) is undoubtedly more than large scale farmers in California could pay. Estimates of what such farmers could afford have been on the order of $10 to $15 or a little more per ton.

3. No sound basis exists for estimating the reaction of large scale farmers to compost. A chemical company in Kansas which produced compost was unable to interest large scale farmers in the product. There is, nevertheless, reason to believe that the market for compost will expand faster than production will develop.

4. There would seem to be a good field for risk capital in commercial composting provided a city is willing to grant a reasonably long-term contract and to consider refuse delivered free to the contractor as representing a saving of the cost of disposal.

In spite of present uncertainties which stem from the lack of specialized equipment, unproven production costs, and uncertain market values, composting represents a very hopeful method for reclaiming municipal refuse economically while producing something immensely valuable to agriculture.

PUBLIC WORKS

EQUIPMENT NEWS

Published Monthly October, 1953

New Sweeper Cleans Two Acres an Hour at Speeds of 2 to 6 mph

Said to do the work of a 3 to 12-man pushbroom crew

MINNEAPOLIS, Minn.—A new sweeper that drives like a car "turns on a dime" and dumps in about 30 seconds has just been announced by G. H. Tennant Co. With speed from 2 to 6 mph and high maneuverability, it is especially suited to sweeping walks, curbs, parking areas, driveways, etc. The sweeper is operated by one man; covers a 36-inch wide path; and picks up dust, debris, paper, glass fragments, sand and other litter "on the run." A 21-inch rotary side brush throws dirt into the main path of the sweeper and increases the effective width to 48 inches.

Sweeping with this machine is said to be practically dust free. A high-speed 36-inch brush, rotating inside a vacuumized compartment, throws heavy debris and dirt into a 9-cu. ft. hopper. At the same time, a high volume 11-inch fan draws lighter dirt and dust into a large fabric bag. A flexible rubber skirt hugs the pavement beneath the brush compartment so that dust cannot escape. A V-type litter scoop, that fits on the front of the sweeper and collects and holds bulky cartons, paper cups, newspapers, bottles, etc. is available as an accessory. With a few turns of a ratchet-type lever, one man can tilt the fully loaded dirt hopper and dump loads weighing up to 700 lbs. in about 30 seconds. Ask for additional information from the G. H. Tennant Company, 2566 North Second Street, Minneapolis 11, Minn.

Power sweeper picks up dirt and litter in parking areas, sidewalks, curbs, etc.

Circle No. 10-1 on Readers' Service Card

"Quick-Way" Introduces Revolutionary Grapple Jawed Bucket for Penetration of Hard Materials

Luke E. Smith and new bucket that will penetrate many hard surfaces and digs rectangular vertical walled holes.

DENVER, Colo.—Luke E. Smith, president of "QUICK-WAY" Truck Shovel Company announced this week the development of a new type attachment you can use to dig bell holes, pole holes, etc., where hard to dig materials are a problem. The same attachment is also a fast material handling bucket as well as a powerful jawed grapple for picking up rubble, blocks of cement, big rocks, pipe, poles etc.

The new "Quick-Way" bucket uses a completely new principle of operation. The bucket is suspended from a specially designed frame of which the hammer drive is a part. The hammer lifts and drops with a pile driver action. As the bucket stands open, jaws spread wide, the hammer impact travels through coupling arms from the base of the hammer plate straight to the teeth of the bucket, driving them into black top, shale, macadam and other hard to penetrate surfaces. Starting from a straight down bite, the clam jaws move in on the radius from both sides to break materials further and pick up a full bucket load. When you don't need the hammer, just bolt it to the bucket head. Different weight hammers are available.

Invented by Luke Smith

This new "QUICK-WAY" attachment was invented by Luke E. Smith, president of the company. It digs a vertically walled hole, rectangular in shape, with even, regular sides and a surface area only slightly larger than the spread of the open bucket. With a trench hoe boom you can dig to a depth of 10 feet and with a crane boom to a depth of 30 feet.

Get complete information from "Quick-Way" Truck Shovel Company, 2401 E. 40th Ave., Denver, Colorado.

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This, the type A.V. air release and vacuum breaking valve, provides a compact unit for releasing air accumulations from pipe line systems automatically, admitting air to systems for breaking vacuums within these systems, and venting large quantities of air from pipe lines when filling systems with water.

The valve is compact in design, having a maximum diameter of 11½ inches with 2-inch threaded inlet opening. Weight of each unit is 160 pounds. More information available from Simplex Valve & Meter Company, 68th and Upland Streets, Philadelphia 42, Pennsylvania.

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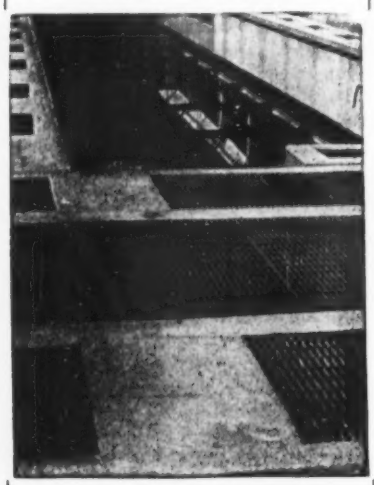

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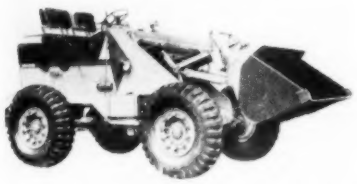
Baker-Lull Offers New Front-End Shoveloader 6,000 lbs. Cap., 4-wheel Dr., Power Steering

MINNEAPOLIS, Minn.—A new front-end shoveloader with 6,000 lbs. capacity, 4-wheel-drive and power steering parallelogram loader action and a 100-inch wheelbase has been announced by Baker-Lull Corp. The machine is rated at 1½ cu. yd. capacity.

The five speed forward or reverse transmission coupled with shuttle gear transmission permits quick change of direction. Power steering on all four wheels (optional) also adds to the operator's ease of control of the unit. Operator safety is insured by location of the seats at the rear and above the engine, away from all moving parts. This advantage also gives the operator an excellent view ahead.



"An excellent unit for jobs requiring high capacity loading" rated at 1½ yd.

Accessories available with the equipment include 1¼, 1½ and 2½ cu. yd. buckets, lifting forks and bulldozer. For literature and price information write Dept. KP, Baker-Lull Corp., 314 W. 90th St., Minneapolis, Minn.

Circle No. 10-4 on Readers' Service Card

M-B Corp. Announces Low-Cost Attachment for Case Tractors

NEW HOLSTEIN, Wisc.—A new low cost grader, designed to be attached to Case SI or DI Tractors has just been announced by the M-B Corporation of this city. Built along the lines of larger motor graders, the maker states this handy, compact unit will handle most any grading and all maintenance jobs, with only a modest initial investment.

The M-B Grader is specifically designed for either the Case SI or DI Tractor and you can attach or remove it in less than an hour, leaving the tractor available for other jobs. You can buy the grader attachment separately for Case tractors now in the field.

Grader frame is built of a heavy tubular section, and the engine location contributes to better traction and far more blade pressure. Circle may be rotated into 5 operating positions and is hydraulically raised and lowered. Hydraulic circle turn is optional equipment. Unit handles 10-ft. blade—three blade pitch position available. A number of attachments, such as a ⅜-yd. front mounted shovel; berm leveler, snow plows; scarifier and bulldozer blade are available for year 'round utility. For full data write M-B Corp., New Holstein, Wisc.

Circle No. 10-5 on Readers' Service Card

M-B grader for Case SI or DI tractor

Handles easy, cuts man power

New Powerful Chain Saw Makes Heavy Cutting Easy

PORT CHESTER, N. Y.—Exceptional power, faster cutting and light weight are among the features incorporated in the Model 5-30, 5.5 horsepower, 30-pound chain saw. According to the maker, Homelite Corp., it will cut through a 20-inch tree in 20 seconds and will bring down timber 4 or 5 feet in diameter quickly and easily. Because of its light and well balanced weight, the saw is extremely easy to handle and cuts in any position—up, down or upside down; on all types of cuts—felling, bucking, boring, notching, trimming or undercutting. Get full details from Homelite Corp., 111 Riverdale Ave., Port Chester, N. Y.

Circle No. 10-6 on Readers' Service Card

Bruner Introduces New Chemical Solution Pump

MILWAUKEE, Wis.—This pump is designed for chlorinating swimming pools, drinking water and industrial wastes. It can also be used for feeding accurately other chemicals used in water treatment. The pump is of the positive displacement diaphragm type operated by an electric motor and can feed up to 60 gallons of sodium or calcium hypochlorite solution a day. It can also be used for feeding alum for coagulation, acids for alkalinity reduction, hypochlorite for sulphur removal, soda for elevation of pH and stabilization, and polyphosphates for corrosion prevention. All parts that come in contact with the pumped solution are chemically resistant plastic or rubber. The pumping chamber consists of a transparent plastic head.

The pump is available in two models, the Model S as described and Model S-Duplex which is a twin head pump so that two different chemical solutions can be used simultaneously. Output of each head is independent of the other and adjustments can be made while the unit is operating. Write for complete information from the Bruner Corporation, 2318 N. 30th Street, Milwaukee, Wisc.

Circle No. 10-7 on Readers' Service Card

Shawnee Angledozer Shifts App. 24 in. Left or Right

TOPEKA, Kans. — The new Shawnee hydraulic angle-dozer, just introduced, has all the advantages of the stationary type blade plus the flexibility of changing the angle from the tractor seat—up, down, angle right or angle left—simply by flipping the valves. "What could be neater," says the maker, "than making a pass in one direction with an angle-dozer then, without leaving the tractor seat, change the angle of the dozer and make another pass?" The blade is manually

"What could be neater than making a pass with an angle-dozer . . . ?"

adjustable and can be shifted about 24 inches to right or left and the horizontal angle of the blade can be tilted up to approximately 20 degrees. Write for more information from the Shawnee Mfg. Co., 1947-L North Topeka Ave., Topeka, Kans.

Circle No. 10-8 on Readers' Service Card

Pneumatic Saw Rips or Angles 18-in. Timber

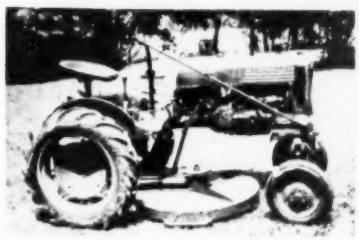
STRATFORD, Conn.—The new model Wright pneumatic saw cuts in hardest-to-get-at places, saws a smooth finish along a chalk-line, cross-cuts, rips or angles through

(*Continued on next page*)

New Attachment Makes Rotary Mower out of Farmall Tractor

OREGON, Ill.—A new single blade rotary mower for use with the International Cub tractor has been added to the line manufactured by Wood Brothers Manufacturing Co. The mower is called the Model 42 and you can mount it underneath the Cub tractor in a matter of minutes. The operator can watch the mowing without turning around. The cutting height is adjustable from 0 to 6 inches by either manual or hydraulic lift, depending on which equipment the tractor has.

Model 42 mows and shreds a 42-in. swath through grass, weeds and brush. It is an ideal machine for mowing along roadways, parks, school grounds, golf course roughs,

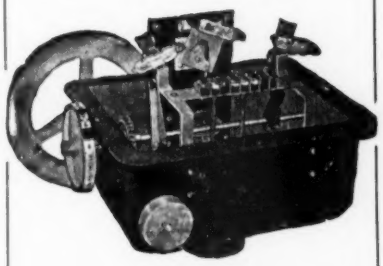


Single blade rotary mower cuts 42 inch swath through grass, weeds and brush

etc. Price of the Model 42 is very low, making it an economical but valuable accessory for Farmall Cub owners. Write Wood Brothers Mfg. Co., Oregon, Ill., for full details.

Circle No. 10-9 on Readers' Service Card

ROTO-TROL



RF-2
with ALTO-TROL

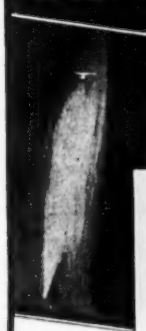
Puts that second pump to work.

A 2-pump RF-2 ROTO-TROL with a built-in ALTO-TROL will operate each pump on alternate starting cycles, assuring equal use and wear of both pumps. Operates both pumps when required.
Depth Indicator optional — extra.
Write for full data.

Water Level Controls Division

HEALY-RUFF Company
791 Hampden Ave., St. Paul 4, Minn.

What does the Price Tag Say?



$500000 the COST OF BLIND DIGGING

Yes, for mere pennies a day you can have the satisfaction and security of knowing exactly where NOT-to-dig, — where pipes and cables are buried. Why take those unnecessary chances when the economical Detectron "505" gives you pin-point accuracy plus greater depth. There's nothing like a "505" Pipe Detector!

7¢ per day for "505" SECURITY Insurance against Costly Preventable Accidents

THE Detectron CO
5420 VINELAND AVE.
NORTH HOLLYWOOD, CALIF.

an 18-inch timber, and saws circles with a 12-inch radius. It employs the reciprocating double sawblade principle. Providing the utmost dependability, heavy-duty construction, easy-grip control handle, and sabre sawblades, the saw gives

'Cuts in hardest to get at places . . "

faster cutting speeds—up to 100% over the earlier models, and low maintenance costs. It can be used profitably by the various departments of cities, counties and states and contractors. Get complete data from Wright Power Saw and Tool Corp., 292 Longbrook Ave., Stratford, Conn.

Circle No. 10-10 on Readers' Service Card

New Portable Compressor Comes in Trailer and Skid Mountings

Available in 2-wheel and 4-wheel trailer and in skid mountings, a new 160 cfm portable compressor has been developed by Davey Compressor Co., Kent, Ohio. This unit has 2 low pressure cylinders with 6-inch bore and 3¾-inch stroke, and one high pressure with 5¼-inch bore and 3¾-inch stroke. It is made in both gasoline and diesel-powered models. Standard features include automatic compressor-engine controls; individually-finned cylinders, separately replaceable; full force feed lubrication; cast aluminum crankcases; multi-port valves; electric starting; automotive type steering; full spring suspension and double, built-in full length tool boxes. The 4-wheel unit is 115 inches long, 75 inches wide, and 70 inches high. Net weight, 4,300 lbs. For more data write Davey Compressor Co.

Circle No. 10-11 on Readers' Service Card

Tail Gate Heater-Mixer Speeds Up Patching and Maintenance

By using this tailgate mixer, called the Heat-A-Mix, cold stockpile material can be made as workable as fresh hot plant mix. The Heat-A-Mix is a compact, high-capacity pugmill and material heater which can be quickly attached to a

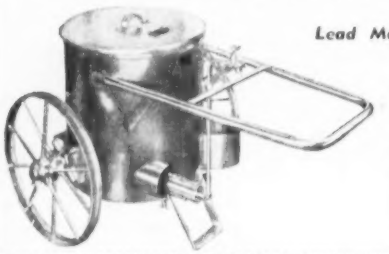
Tailgate mixer makes cold stockpile material work like fresh hot plant mix

dump truck for patching and maintenance work. It has its own gasoline engine and a propane gas heater. The stockpiled mix is carried in the truck's dump body and is charged as needed into the mixer. The capacity is 10 tons per hour and the weight of the unit is 1,000 pounds. Only one man is required in the truck to charge and operate the heating and mixing unit, which can be quickly detached. Full information from Wylie Mfg. Co., Inc., 5926 NW 39th St., PO Box 7086, Oklahoma City, Okla.

Circle No. 10-12 on Readers' Service Card

PORTABLE COMPOUND POTS
with BOTTLED GAS burners!

Fast heating Aeroil Compound Melting Pots on steel wheels for melting of sewer pipe compounds, G-K, Sewer-Seal, Mineral Lead, asphalt, tar, pitch, and similar compounds. Available for prompt shipment with bottled gas burner or kerosene burner outfit. 15, 25, and 50 gallon capacities.



Lead Melting Furnaces

on steel wheels for efficient melting of lead, babbit and soft metals. Bottled Gas burner or Kerosene burner outfit. 200, 450 and 850 pound capacities.

AEROIL PRODUCTS COMPANY, INC.
19 WESLEY STREET • SOUTH HACKENSACK N. J.

Please send free description bulletin on Compound Pots and Lead Furnaces.

NAME .....
ADDRESS .....
CITY .....
STATE .....

First and Foremost in the **FLOATLESS CONTROL FIELD**

B/W

Floatless
LIQUID LEVEL and INDUSTRIAL CONTROLS
Write for Catalog
B/W CONTROLLER CORPORATION
2224 East Maple Road, Birmingham, Michigan

FIRST IN THE FLOATLESS CONTROL FIELD

Hydraulic Elevating Tailgate Makes Lifting into Truck Easy

A new and improved Heiloader hydraulic-powered, elevating truck tailgate is now available to truck owners. This unit can be mounted on any truck and can lift a maximum of 2,000 lbs. It incorporates new operating and safety features, enabling one man to handle heavy or

New Heiloader lifts as much as one ton

bulky objects with complete safety and without strain. Two types of platforms are available. The floor is corrugated for greater load capacity and to prevent floor sag. The unit is applicable to scores of different city, county and state jobs; approximate weight on the rear of a truck is 725 lbs.; total weight is 850 lbs. A control lever is placed on each side of the truck. Send for more data from The Heil Co., Milwaukee, Wis.

Circle No. 10-13 on Readers' Service Card

Light Saw Cuts Brush and Trees Up to 4"

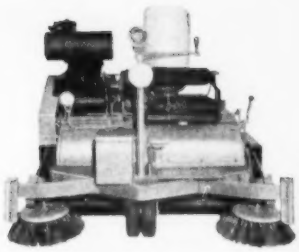
This saw has been designed especially for cutting brush. The circular saw is driven by a gasoline

No longer the start of a long, tedious job

motor and the entire outfit can be handled safely by one man. It weighs only 35 pounds. The maker says you can cut brush up to 4 ins. in diameter, easily and economically. For further information, write Brushmaster Saw, Inc., Keene, N. H.

Circle No. 10-14 on Readers' Service Card

CUT YOUR SWEEPING COSTS



75%

WILSHIRE

POWER SWEEPERS

WILSHIRE
MUNICIPAL MODEL 1000-S
Unit shown above (No. 1148) has 2 Side Sweepers, self-starter, head, tail and spotlights for constant duty operation. It sweeps a 70-inch swath at speeds from 3 to 12 miles per hour.

Free DEMONSTRATION PROVES IT

Hundreds of communities and cities, large and small, have discovered WILSHIRE sweeps faster, cleaner and without dust. It gets in and out of the tight places without bottling up traffic and that makes it ideal for narrow streets and alleys, around safety islands and in congested areas. Write for illustrated brochure.

WILSHIRE POWER SWEEPER COMPANY • 526 W. Chevy Chase Drive • Glendale 4, Calif.

HYDRO-TITE

DEPENDABLE JOINTING COMPOUND

Seals Bell and Spigot Water Mains

Economical—Effective

Over 35 Years Of Dependable Performance

HYDRAULIC DEVELOPMENT CORP.

MAIN SALES OFFICE 50 CHURCH ST., N. Y. C.

General offices and works W. Medford Sta., Boston, Mass.

WATER SUPERINTENDENTS:

Consider the Advantages of Pollard L-P Gas Burner Furnaces

Burns L-P Gas (commonly known as "Bottled Gas"). Thoroughly tested and proven. Melts approximately 50 lbs. of lead in 9 minutes. Flame can be adjusted to maintain desired temperautre. One cylinder of gas will operate unit for many hours. Cylinders are made of armor plate.

Catalog No. 26 on Request.

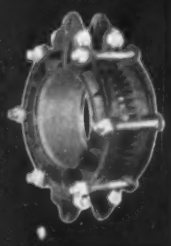
JOSEPH G. POLLARD CO., Inc.
PIPE LINE EQUIPMENT
New Hyde Park, N. Y.

FOR REPAIRING BELL AND SPIGOT JOINT LEAKS...

SKINNER-SEAL Bell Joint Clamp for stopping bell and spigot joint leaks under pressure. Gasket is completely sealed: at bell face by Monel Metal Seal band — at spigot by hard vulcanized gasket tip. 2" to 42".

AND BROKEN MAINS

SKINNER-SEAL Split Coupling Clamp. One man can install in 5 to 15 minutes. Gasket sealed by Monel band. Tested to 800 lbs. line pressure. A lasting repair. 2" to 24" incl.



M. B. SKINNER CO.
SOUTH BEND 21, INDIANA, U.S.A.

INCREASE SEWAGE PLANT CAPACITY WITHOUT CAPITAL COST!

WHAT IS IT?

- BIONETIC is a dry powder of preserved beneficial groups of micro-organisms that accelerate natural biological action.

WHAT DOES IT DO?

- BIONETIC can save money on sewage plant problems including odor control, increased sludge digestion capacity, and scum blanket control.

INTERNATIONAL ACCEPTANCE:

- BIONETIC is successfully used by hundreds of municipalities, industries, resorts, and institutions.

For FREE Literature Write:
A. J. Krell, technical director
Reliance Chemicals CORPORATION
P. O. BOX 6724 HOUSTON 5, TEXAS

Classified Advertising and Used Equipment For Sale

ASSISTANT CITY ENGINEER $505 — $615

Kansas City Missouri will examine applicants for the position of Assistant City Engineer on a nationwide basis. Will have responsible charge of the preparation of plans and specifications for Municipal trafficways, airports, bridges, sewers, buildings and similar projects; supervise construction work, make surveys and prepare engineering reports; perform related work. Starting salary at level commensurate with ability and experience. Write for application forms c/o Personnel Department, 12th Floor, City Hall, Kansas City 6, Mo.

CITY ENGINEER WANTED

Salary $6300—7200. Retirement plan plus Social Security. Works under direction of Director of Public Works. Apply City Manager, Kenosha, Wisconsin before November 13.

Wanted

REPRESENTATION.

There are some valuable open territories available to responsible firms and individuals that have a primary interest in the treatment of sewage and industrial wastes. It is essential to have a good technical background in working with cities and industries.

The product is BIONETIC, a biological additive consisting of preserved microorganisms.

Your inquiry is invited.

Address replies: President,
Reliance Chemicals Corporation
P.O. Box 6724, Houston 5, Texas

POSITION WANTED

Civil Engineer — 30, with 7 years experience in sanitary engineering, administration and public relations, desires municipal engineering position in city 25,000—50,000. Northeast preferred.

Write To
LT. JAMES L. RODGERS, JR.
U. S. Naval Construction Battalion Center
Port Hueneme, California

REPRESENTATION AVAILABLE

With four sales engineers actively calling on Consulting Engineers, municipalities, and industries throughout the six New England states, we would like to learn of manufacturers interested in obtaining New England representation. Address:
ENGINEERING SALES CORPORATION
2300 Washington Street,
Newton Lower Fal's 62, Mass.
Decatur 2-3900

DEAERATOR TANKS

19 Cold water deaerators, rubber lined, never used, 3,000 gal. per minute. Tanks are 11' by 56' built for pressure and vacuum, price $11,000, F.O.B. cars.

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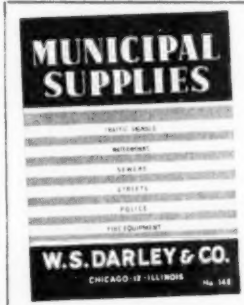
George R. Marvin Company
BR 2207
1601 Taylor Way — Tacoma, Washington



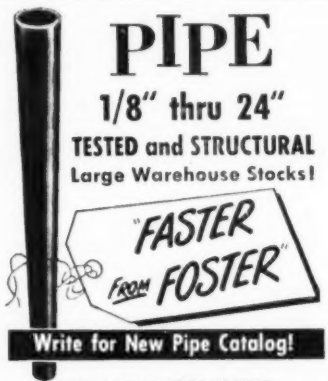
WRITE TODAY FOR 100 PAGE CATALOG

W. S. DARLEY & CO., Chicago 12

STREET, SEWER AND WATER CASTINGS

Various Styles, Sizes and Weights
Manhole Covers and Steps
Adjustable Curb Inlets
Water Meter Covers
Cistern and Coal Hole Covers
Gutter Crossing Plates
Valve and Lamphole Covers

Write for Catalog and Prices
SOUTH BEND FOUNDRY CO
Gray Iron and Semi-Steel Castings
SOUTH BEND 23, INDIANA



L.B. FOSTER CO.
Pittsburgh 30, Pa. • Los Angeles 5, Cal.
Houston 2, Tex. • Chicago 4, Ill. • New York 7, N.Y.

Small City Budget

(Continued from page 89)

rather than have some members feel that other council members had influenced our thinking too much on certain requests.

All items of a luxury nature were omitted. It was believed that the taxpayers would not approve luxuries since the growth of the city demanded so many necessities.

Some of the department's estimates were easy as they concerned only replacements or additional equipment; however the street, fire and utility departments were extremely difficult. These departments required the most work and study. It will be these departments that will have to expand more and faster in order to keep up with Pampa's growing pains.

The last step in the process was to bring the Department Heads together and discuss the pros and cons of each request. This was done in order that each person would know the final decisions made. Some requests of one department would of necessity affect requests of another. We wanted a well-balanced budget and one that the employees of the City could unanimously adopt.

Space does not permit the inclusion here of a complete copy of our capital outlay budget for the next three years. The totals are: For 1953-4, current fund $77,800, bond fund 527,000; for 1954-5, current fund $75,100, bond fund $585,000; for 1955-6, current fund $45,200, bond fund $522,000. As would be expected, much of the bond fund is for water and sewer department improvements.

• • •

City Engineer Wanted

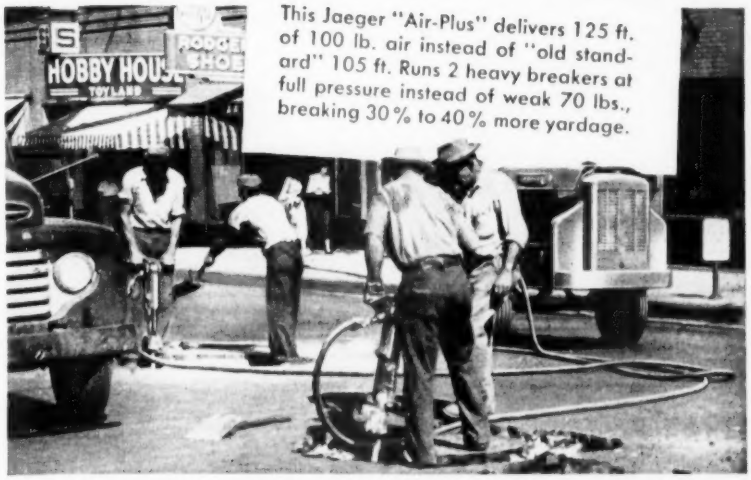
The City of Kenosha, Wis., is asking for applications for the position of City Engineer. Applicant must be a Civil Engineering graduate and have had at least five years of progressively responsible experience in the field of public works engineering. Salary range begins at $6300. Apply to City Manager, Kenosha, Wis., before Nov. 13.

• • •

Engineer Desires Position

Civil Engineer, 24, with Master's degree, some design experience, desires position in the public works or municipal field in vicinity of New York. Just out of Air Force after tour of duty. Write T. A. Merkin, 160 West 77th St., New York 24.

You Can Do 4 Days' Work in 3 with "New Standard" Jaeger Compressors



This Jaeger "Air-Plus" delivers 125 ft. of 100 lb. air instead of "old standard" 105 ft. Runs 2 heavy breakers at full pressure instead of weak 70 lbs., breaking 30% to 40% more yardage.

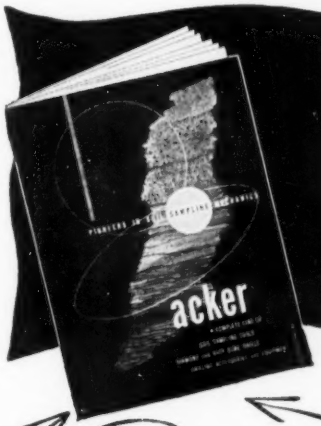
75 ft.
125 ft.
185 ft.
250 ft.
365 ft.
600 ft.

30% to 40% increases in production are yours with any "new standard" Jaeger from Model 75 that holds full pressure in a heavy pavement breaker up to Model 600 that runs 2 heavy wagon drills at full pressure with air to spare for hand-held drills. Jaeger Compressors deliver this 15% to 25% extra air at lowest cost per cubic foot of air of any compressor.

See your Jaeger distributor or write for Catalog JC-1.

THE JAEGER MACHINE COMPANY 400 Dublin Avenue Columbus 15, Ohio

PUMPS • MIXERS • HOISTS • TRUCK MIXERS • PAVING SPREADERS and FINISHERS



FREE! SOIL SAMPLING CATALOG

OVER 80 ILLUSTRATIONS

33 YEARS IN THE MAKING

This complete, instructive collection of information about soil sampling in all subsurface conditions, shallow or deep, with hand or power driven tools, is yours for the asking. Modern sampling techniques are discussed with recommendations as to tools and accessories best suited for fast, accurate, economical sampling.

Use the coupon or write for Bulletin 25.

REMEMBER, Acker also makes a complete line of Diamond and Shot Core Drills, Drilling accessories and equipment.

★

ACKER DRILL COMPANY, INC.
Scranton, Pa.
Pioneers in Soil Sampling

Send me my free copy of Bulletin 25-PW.

Name _____ Title _____

Firm _____

Street _____

City _____ State _____

Thousands use our Readers' Service card to keep up to date . . . do you?

"Hippocrates' sleeve" (a cloth straining bag) was a popular water treatment method in the 4th Century B.C.

For excellence in MODERN water treatment equipment —gravity and pressure filters— recirculation apparatus...

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

ROBERTS FILTER MANUFACTURING CO.
640 COLUMBIA AVE., DARBY, PA.

TAPAX
Takes the BANG out of Manhole Covers

INSTALLING TAPAX—a matter of minutes

Brush Away Dirt & Gravel

Cut Required Length

Place Tapax sticky side down

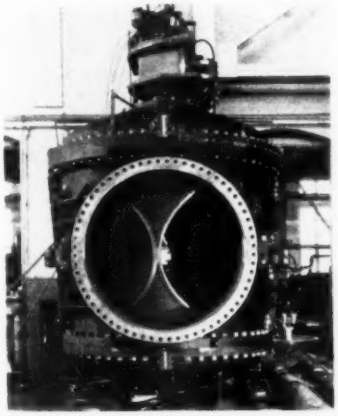
Replace Cover

Write for Bulletin No. 11

JOSEPH G. POLLARD CO., Inc.
Pipe Line Equipment
NEW HYDE PARK, NEW YORK

INDEX OF ADVERTISEMENTS

WORTH SEEING

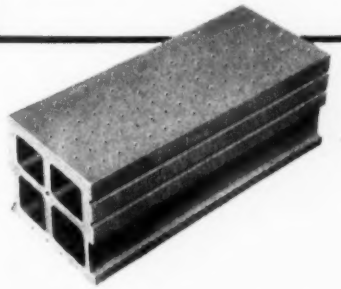


YOU MAY NOT need a Rotovalve like this 84-incher very often, but when you do remember it as a star attraction at formal opening in August of S. Morgan Smith Company's new $3,000,000 plant addition in York, Pa. Valve is one of three destined for Afghanistan.

SHOWING Tilt-Cab feature of Diamond T cab-over-engine trucks. You can get to the engine in one minute flat if need be, bare handed.

CEDAR RAPIDS Iowa's motto "Clean Homes Make a Parlor City" is realized with the increase to 11 of modern, sanitary HEIL Colecto-Pak units shown here. The biggest smile identifies the Heil distributor!

IT PAYS TO *Specify*
LEOPOLD
Glazed Tile
FILTER BOTTOMS



PERFORMANCE PROVED IN OVER 200 PLANTS WITH A DAILY CAPACITY OF MORE THAN 900 MILLION GALLONS!

With its many exclusive advantages, the Leopold Compound Duplex Filter Bottom provides the most practical and economical answer to your underdrain problems.

In this design, laterals and distributing blocks are combined in one permanent unit that insures uniform filtration over the entire filter bed and equal distribution of the wash water with minimum loss of head. The individual blocks—each about two square feet in area and weighing approximately 100 pounds—are made of highest quality de-aired fire clay, vitrified and salt glazed. They resist corrosion, are not subject to tuberculation, won't absorb any detrimental amount of water, and are impervious to acids and alkalis.

Adaptable to any rectangular filter unit, the efficient Leopold Filter Bottom needs only a shallow depth of small sized filter gravel to support the filtering medium. Further, the Leopold design does not require special supporting concrete members or the added concrete construction of a false bottom.

Complete Water Purification and Sewage Plant Equipment . . .

- **DRY CHEMICAL FEEDERS**
- **FILTER OPERATING TABLES**
- **MIXING EQUIPMENT**

Write today for details

F. B. Leopold Co., Inc.
2413 W. Carson Street
Pittsburgh 4, Pa.

Ask the man behind the gun . . .

White gives you everything you want in an engineer's transit

Shown, model 7014 with "A" standard. "U" type also available. $575.00* complete with tripod case and field equipment.

WHY are more and more engineers and builders choosing White Engineers' Transits? Basically, the reason is simple: White transits are designed and built for the man in the field. They incorporate all the work-saving, accuracy-boosting features . . . the rugged construction . . . the simplified quality components that you want. In addition, you get coated optics, covered leveling screws and internal focusing Telescope. Wide frame tripod is optional.

YOUR CHOICE OF THREE RETICULES AS SHOWN BELOW —

Fig. I Close hair arrangement for our standard levels.

Fig. II Stadia hair arrangement for our standard transits.

Fig. III Special stadia hair arrangement, furnished upon request.

To get the details on the complete White line of instruments for Engineers, Surveyors and Builders, write for Bulletin 1053, DAVID WHITE COMPANY, 399 W. Court Street, Milwaukee 12, Wisconsin.

DAVID WHITE COMPANY

We offer the most expert REPAIR SERVICE on all makes, all types of instruments

*Prices subject to change without notice.

WORTH TELLING

by Arthus K. Akers

★ **JEFFERSON ELECTRIC COMPANY,** Bellwood, Ill., lands the largest order for airport lighting transformers placed by the U. S. Air Force since World War II.

★ **CATERPILLAR TRACTOR** announces that Decatur, Ill., will be the site of its huge new factory.

Mr. Row

★ **HAL J. ROW** becomes sales promotion manager, The HEIL COMPANY, Milwaukee. He will act as coordinator on promotional matters between the Heil Body and Hoist Division, which includes garbage and refuse collection bodies, and Heil distributors throughout the country.

★ **The ASPHALT INSTITUTE,** New York, has promoted ARVIN S. WELIBORN from managing engineer of the Pacific Coast Division to chief engineer, in the home office.

★ **BROWN COMPANY** (Bermico pipe) moves its California office to Monadnock Building, San Francisco.

★ **DARLING** VALVE & MANUFACTURING COMPANY, Williamsport, Pa., appoints FRANK B. KREIDER as general Sales Manager.

★ **E. D. WEST** has been named general sales manager, CLIMAX ENGINE AND PUMP MANUFACTURING COMPANY, with headquarters in Chicago.

★ **AMERICAN-MARIETTA COMPANY,** Chicago, becomes the nation's largest producer of concrete sewer and drain pipe, they announce, with their acquisition of controlling interest in the UNIVERSAL CONCRETE PIPE COMPANY, of Columbus, Ohio.

★ **FREDERIC A. WYATT,** member of the UNION COLLEGE (Schenectady) staff, has resigned to become vice-president of the A. REED WILSON COMPANY, Kansas City, manufacturer of the WB "Manhole Adapter".

★ **AMERICAN BITUMULS AND ASPHALT COMPANY,** San Francisco, will construct a $4,000,000 asphalt refinery near Cincinnati. Also new terminals at Troy and Lyons, N. Y.

★ **SOME 400** guests, including our LEW MORRIS, attended the inaugural luncheon and inspection trips through the new S. MORGAN SMITH COMPANY plant additions at York, Pa., August 25. See "Worth Seeing" department in this issue for one thing visitors saw.

★ **KOPPERS COMPANY** Tar Products Division promotes EARL F. BENNETT to manager of Road and Building Materials Section. DR. J. N. ROCHE will manage Sales Development Section.

★ **ROBERT E. OCKFORD** is new northeastern representative, LESSMANN MANUFACTURING COMPANY, operating out of Philadelphia.

Mr. Ockford

Mr. Clow

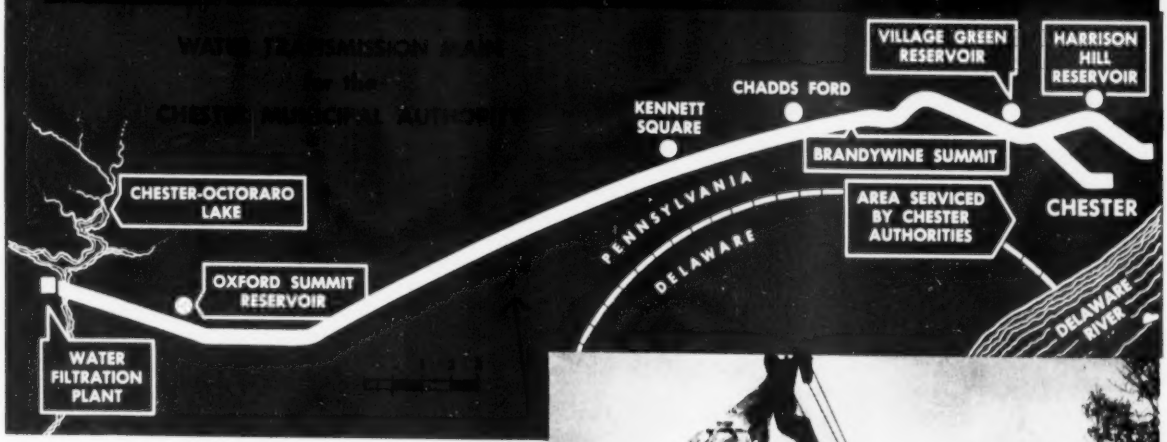
★ **DEATH** again takes no holiday in the JAMES B. CLOW & SONS organization, leading cast iron pipe makers. This time it took WILLIAM E. CLOW Jr., chairman of the board since February. Previously it was J. BEACH CLOW, in May.

★ **ED. C. MILLIKEN** of The BOWERSTON (Ohio) SHALE COMPANY also joined the Great Majority, suddenly on August 23.

★ **MANY** fire trucks take a dog along in answering alarms. Presumably to locate fire hydrants.—*Sparling Metrograms.*

a 44 mile LOCK JOINT pipeline

...with a Hazen-Williams "C" of 150



IN TESTS on 233,000 feet of 24", 30", 36", 42" and 48" Lock Joint Prestressed Concrete Cylinder Pipe in Chester, Pa. the eminent hydraulist, F. C. Scobey, found a coefficient of 150. This gives the city a premium capacity of 11%. Leakage was a mere 12% of the maximum allowed by the Consulting Engineers. Thus Chester enjoys greater capacity with far less waste than the city anticipated — truly premium performance in every sense. For similar trouble-free operations, let Lock Joint supply your needs in pressure pipe 16" and larger.

Laying a section of the 48" pipe for the Chester Water Supply Main

SCOPE OF SERVICES: *Lock Joint Pipe Company specializes in the manufacture of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains 16" in diameter or larger, as well as Concrete Pipes of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.*

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Established 1905

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Reinforced Concrete
PRESSURE PIPE

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LOSS-OF-WEIGHT RECORDING

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Volumetric feeding with its simplicity, dependability and economy can now be supplemented with the following benefits of loss-of-weight recording:

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- Periods of feeder operation
- Time of hopper loading
- Quantity of chemical added at each loading

PLUS THE CONVENIENCE OF...

- Direct reading register that gives the hopper contents at a glance
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- A mechanical poise weight drive for rebalancing after loading

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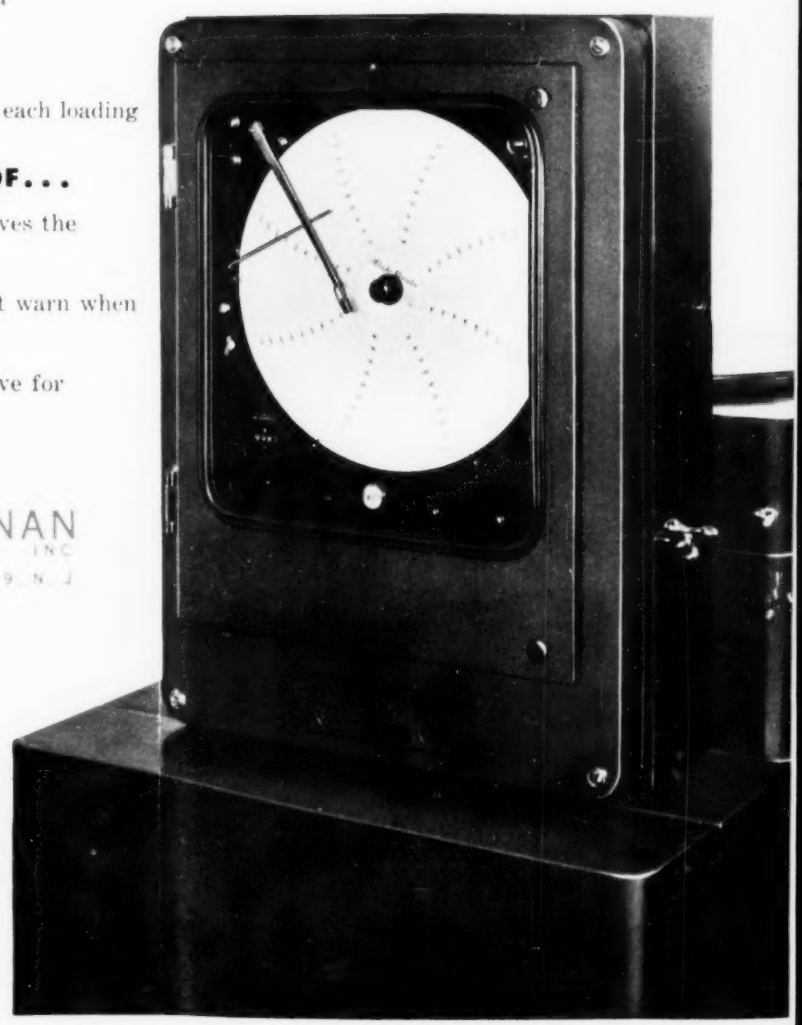

TP-75-C-2 gives further information on the W&T Series A-635 Volumetric Fluoridator